



Characteristics and Importance of Freight Aviation in the MAASTO Region

MID-AMERICA



FREIGHT COALITION

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About the Mid-America Freight Coalition (MAFC)

The industries and farms of the Mid-America region can compete in the marketplace only if their products can move reliably, safely and at reasonable cost to market.

State Departments of Transportation play an important role in providing the infrastructure that facilitates movement of the growing amount of freight. The Mid-America Freight Coalition was created to support the ten states of the Mid America Association of State Transportation Officials (MAASTO) region in their freight planning, freight research needs and in support of multi-state collaboration across the region.

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1. INTRODUCTION

The Mid America Association of Transportation Officials (MAASTO) represents the 10 Mid-America states of Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. The transportation agencies in these states are responsible for multimodal freight transportation systems within their states. As a region, they seek to work cooperatively for localized and regional benefits to freight movement, traffic safety, efficient transportation, and economic development. Freight movement is a key component of this focus. The MAASTO region is a national leader in collaboration to develop regional freight plans and implement projects that support not only a single state freight system and economy, but also the regional system and economy. The association between these states exceeds its peers in regional efforts to support and advance multimodal freight systems. These efforts demonstrate the region's leadership in working to provide an efficient multimodal freight system without borders. This project is the next step in MAASTO's freight planning efforts to better align and leverage the value of regional aviation freight planning and coordination.

This project provides an overview and description of the freight aviation system and its extent and importance across the MAASTO region. It will also examine regional connections that support domestic and international freight aviation movement. The project will provide agencies and decision-makers with information necessary to plan and leverage aviation freight assets for states and the MAASTO region.

Project Objective

The project's objectives are to provide a baseline overview of the aviation network in the MAASTO region, its importance to the region's economy, and trends in freight aviation. This report summarizes freight aviation volume and cargo data, identifies major regional freight aviation hubs and networks, and discusses freight aviation strategies and development perspectives for the MAASTO states.

Based on the information provided in the report, decision-makers will be able to describe the status, extent, and importance of the system, and advance policies to support this critical component of the freight system.

Scope of Work

This project assesses the MAASTO regional freight aviation system, utilizing various data and information sources, through the following tasks:

1. Identify state, federal, and industry freight aviation data, including weight and value of freight moved, prominent cargos, and origin and destination points for major regional facilities.
2. Identify significant freight aviation facilities (hubs) across the region and by state based on freight volumes and based on input from state technical representatives.

3. Develop mapping and tables to portray the state and regional freight aviation system, including national and international connections.
4. Compare current findings with a previous MAFC/CFIRE assessment of freight aviation in the MAASTO region.

Organization of the Report

The report is organized as follows:

- Chapter 2 presents an overview of the Air Freight industry, definitions, and its relevance in the MAASTO region.
- Chapter 3 gives an overview of factors influencing air cargo activity in the MAASTO region.
- Chapter 4 presents an assessment of Air Cargo activity by weight in the MAASTO region.
- Chapter 5 presents an analysis of Air Cargo activity by value and commodity type for the region.
- Chapter 6 provides a case study of the Louisville, Kentucky airport that has seen massive growth in recent years.
- Chapter 7 provides an overview of freight aviation issues and discussion on strategic development within the MAASTO region.
- Chapter 8 presents a summary and concluding remarks for the study.

2. AIR CARGO - BACKGROUND

This chapter presents an introduction and overview of the air cargo industry in general, with an introduction to the relevance of the industry within the MAASTO region.

Overview of the Air Cargo Industry

The U.S. air cargo industry dates back to the early 1900s with the establishment of air mail routes across the country. The Airmail Act of 1925 established nationwide air mail service for the United States Postal Service. The introduction of jet airplanes further improved the overall speed of delivery for air cargo. Interested readers are encouraged to consult The History of Air Cargo and Airmail for a more detailed history of the air cargo industry [1], and the Mid America Freight Coalition's (MAFC) 2010 report on aviation in the MAASTO region [2].

Air Carriers

Air cargo transportation involves companies/airlines that provide a range of freight services depending on their business model and aircraft. The system includes a combination of all-cargo carriers, combination carriers, and freight forwarders.

Table 1 shows a listing of types of air freight carriers, examples of each carrier type, and their characteristics. All cargo carriers are airlines that carry only cargo, and can be further classified as integrated carriers, or traditional/line-haul carriers. Combination carriers are airlines that carry both passengers and cargo with the cargo loaded below the main deck. Such carriers are often also referred to as belly cargo carriers. Some mixed carriers have separate operations for transporting freight through all-cargo aircrafts in addition to the bellies of their passenger carrying services.

Table 1: Types and Characteristics of Air Cargo Carriers

Type of Carrier	Example of Carrier	Characteristics	Customers	Market/ Movement	Type of Cargo
Combination Carrier	Most passenger airlines	Baggage hold of passenger aircraft	Wholesale, mail, retail	Airport to airport	Mail, freight
Integrated Carrier	UPS, FedEx	Main decks of all-cargo aircraft	Retail	Door to door	Packages, Express
Traditional/ Line-Haul Carrier	Polar, Kalitta, World Airways, BAX Global	Main decks of all-cargo aircraft	Wholesale	Airport to airport	Larger, specialized freight
Freight Forwarders	Panalpina, Forward Air	All-cargo and passenger aircraft	Wholesale	Feeder services (pickup and delivery)	Ocean and air freight pickup and delivery
Source: Compiled by TTI, Air Transport Association, International Air Cargo Association					

There are three types of aircraft typically used for air cargo: passenger, freighter, and combination. All types of passenger aircraft are used for cargo transport, with the belly area of the aircraft used for cargo. Freighter aircraft are similar to their passenger counterparts but are configured for freight-only operations. On freighter aircraft, cargo is transported on both the main deck and the lower deck. Combination aircraft are aircraft that can be configured for either passenger or cargo operations, with the option of converting between the two as needed.

The growing demand for air cargo has created a strong market for more all-cargo and integrated carriers. The impact of the COVID-19 pandemic also boosted demand for air cargo services. Unlike the combination carriers that carry both passengers and belly freight, all-cargo carriers transport only cargo on the main decks of the aircraft. All-cargo carriers can be further classified as integrated carriers or traditional/line-haul carriers. Integrated carriers are those that provide door-to-door service such as UPS and FedEx. The air distribution networks of integrated carriers resemble a hub-and-spoke system similar to that of passenger airlines.

Traditional/line-haul carriers are those that typically provide airport-to-airport service and include carriers like Polar and BAX Global. Integrated carriers may have a “one-stop shop” approach and provide air and trucking services under one company. All-cargo and integrated carriers can offer speed that other modes, such as trucking, cannot provide and the dedicated service focus that belly cargo carriers are unable to provide.

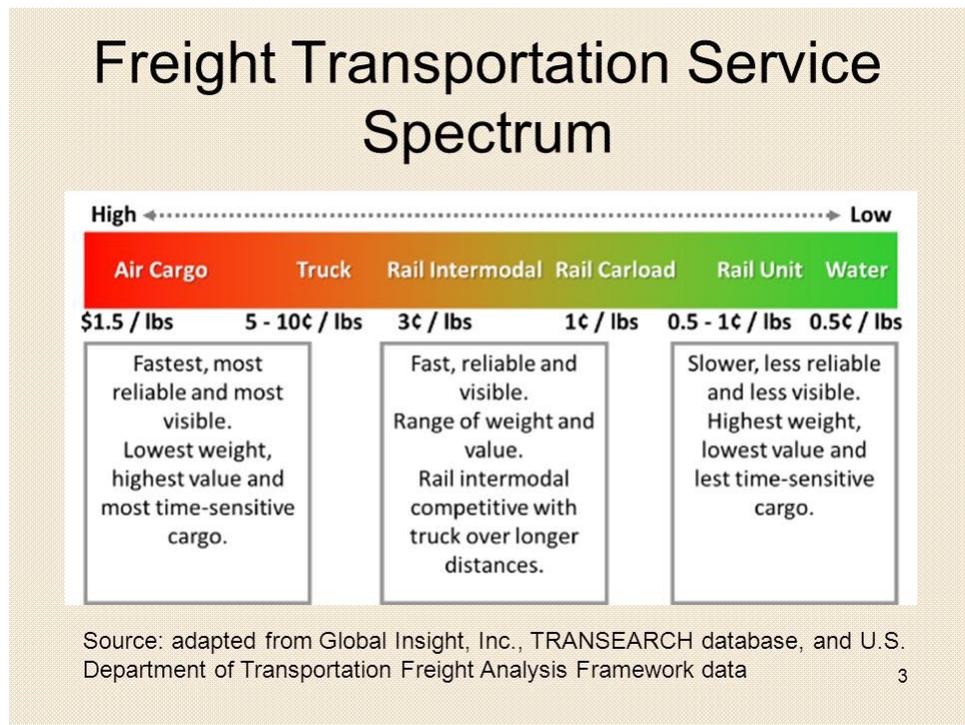
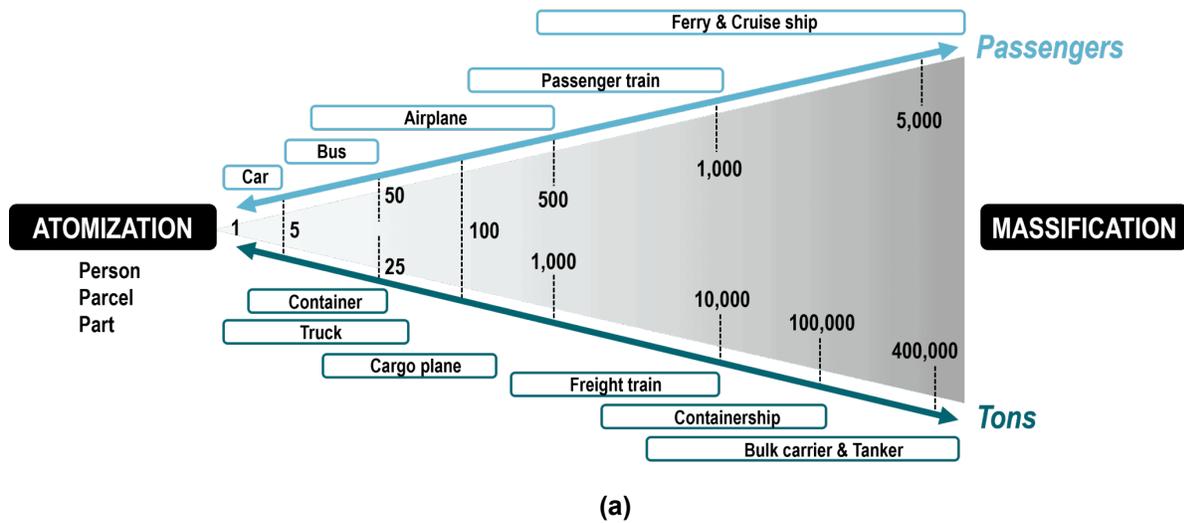
Types of Air Cargo

Air cargo transportation primarily has two categories of cargo: time-sensitive cargo and value-sensitive cargo [1].

Table 2: Types and Examples of Cargo Transported by Air

Time-Sensitive Cargo	Value-Sensitive Cargo
Perishables (e.g., flowers, fruits, or vegetables)	Medicines/Pharmaceuticals
Live Animals	Electronic Components
Bakery/Other Food Products	Photographic Equipment
Express Parcels/Documents/Newspapers	Chemicals
Obsolescent Items (e.g., apparel or footwear)	Machine Parts
Emergency Items (e.g., drugs or machinery parts)	Fragile Goods
Humanitarian Aid (e.g., food, medicine, potable water)	

Table 2 shows the cargo categories and examples of cargo typically transported by air within the categories. Time-sensitive cargo includes perishables such as food products, cargo with high urgency such as emergency items, and express parcel shipments including documents and express mail. These products are shipped by air due to the speed advantage compared to shipping via other modes.



(b)

Figure 1: a. Atomization versus Massification in Transportation Modes [3], b. Freight Service Spectrum [Source: Presentation “Transportation and Distribution Management”, 2015]

Value-sensitive cargo is high in value and relatively lightweight. This category includes items such as pharmaceuticals and electronic equipment. These items also benefit from the speed advantage of air cargo transportation, as the high-value products are not exposed to long travel times and

thus have less exposure to issues related to security or handling across multiple modes. Figure 1 (a and b) below provide visualization of the relationship between freight services and cargo types. These graphics, referred to as continuum of atomization and massification, and the freight service spectrum, reflect the relationship between speed, value, and weight in shipping.

Airports

The scope of this report includes every airport, private and public, eligible for Airport Improvement Program (AIP) funding through the Federal Aviation Administration (FAA) within the 10-state MAASTO region. The FAA considers all “public-use airports” eligible for AIP funding. The FAA defines a “public-use airport” as an airport which must be “publicly owned, or privately owned but designated by FAA as a reliever, or privately owned but having scheduled service at least 2,500 annual enplanements.” [4] Airports eligible for AIP funding are included in a biennial National Plan of Integrated Airport Systems (NPIAS). More information on AIP eligible airports, criteria for AIP eligible designation, and list of airports, please refer to FAA’s website [5]. The most recent NPIAS covers the time period 2021 through 2025 and was published in September 2020 by the FAA [4].

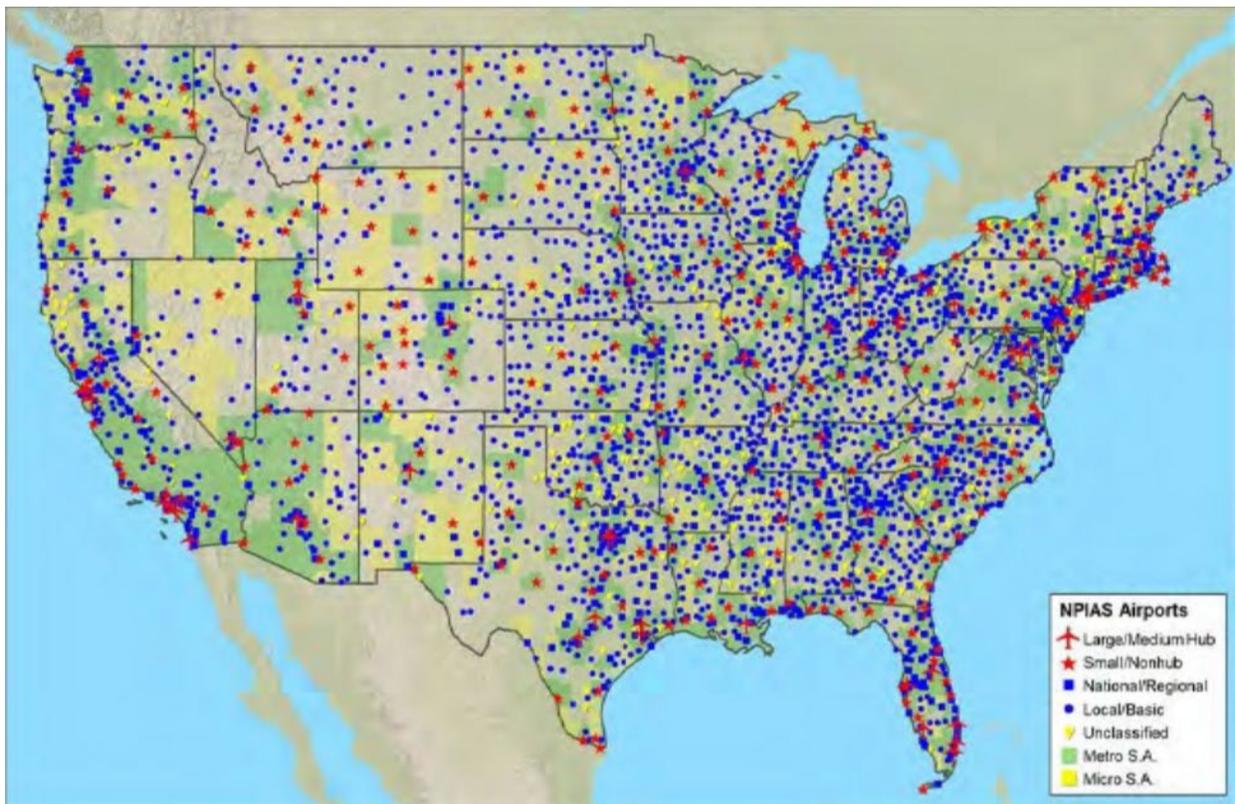


Figure 2: NPIAS Listed Airports (FAA website [3])

NPIAS publications list airports across the country along with their locations, ownership details (Public, Private, Military, or Native American), categories (commercial service, reliever, or general aviation), hub categorization (large hub, medium hub, small hub, or non-hub), role (national,

regional, local, basic, or unclassified), and enplaned passengers. Figure 2 shows a map of all listed NPIAS airports in the US. Individual state maps for the MAASTO region states are provided as an appendix (Appendix A) to the document.

Overview of Recent Freight Trends

Much of the recent increase in home delivery is enabled by freight aviation. While passenger aviation took a tremendous blow from the COVID-19 pandemic, freight aviation remained critical and appears to be part of the evolution of package movement towards nearly instantaneous availability of consumer goods and high-value industrial components. As reported by the Organization for Economic Co-operation and Development (OECD), “air transport represents a small share of GDP but is closely linked to the activities of other sectors, especially airports and aircraft manufacturing – collectively considered here as the “aviation industry”. The aviation industry is a key enabler of many other economic activities” [6].

The report further suggests that the contraction in transportation services due to COVID-19 impacts affected the overall sustainability of the entire system, including the freight components. The COVID-19 impacts are summarized by the U.S. International Trade Commission (USITC) as, “The first, and most significant impact was a sharp decrease in capacity to transport freight in the cargo holds of passenger aircraft (“belly cargo”) due to canceled flights. The second impact was a pandemic-related increase in air freight demand for certain merchandise imports, primarily for products like personal protective equipment (PPE) [7]. These impacts resulted in a steep increase in air freight rates compared to 2019, as well as increased volatility in these rates compared to previous years. These impacts varied by region; however, with Asia-North America routes the most affected.”

It is important to note the role freight aviation had in the distribution of PPE, nationally and internationally. In summary, the Trade Office states,

“The shipping challenges and increased costs resulting from the COVID-19 pandemic did not result in a major change in the shipping mode used for imports from Northeast Asia in 2020, except in the textile and apparel sector. In textiles and apparel, the share of goods shipped by air freight increased from 9 percent in 2019 to 22 percent in 2020, reflecting the large volume of PPE shipped via air freight.”

There were smaller increases in the share of goods shipped via air freight in other sectors, such as chemicals and electronic products. In addition, there were also certain COVID-19-related trends that encouraged more use of air freight for certain goods in these sectors. However, these shifts are a continuation of trends over the five-year period so the extent of the impact of COVID-19-related shipping disruptions is unclear.

In a recent BTS report on COVID-19 funding, aviation represents the largest percent of emergency funds to any of the recipient areas and modes as shown in the graph below [8].

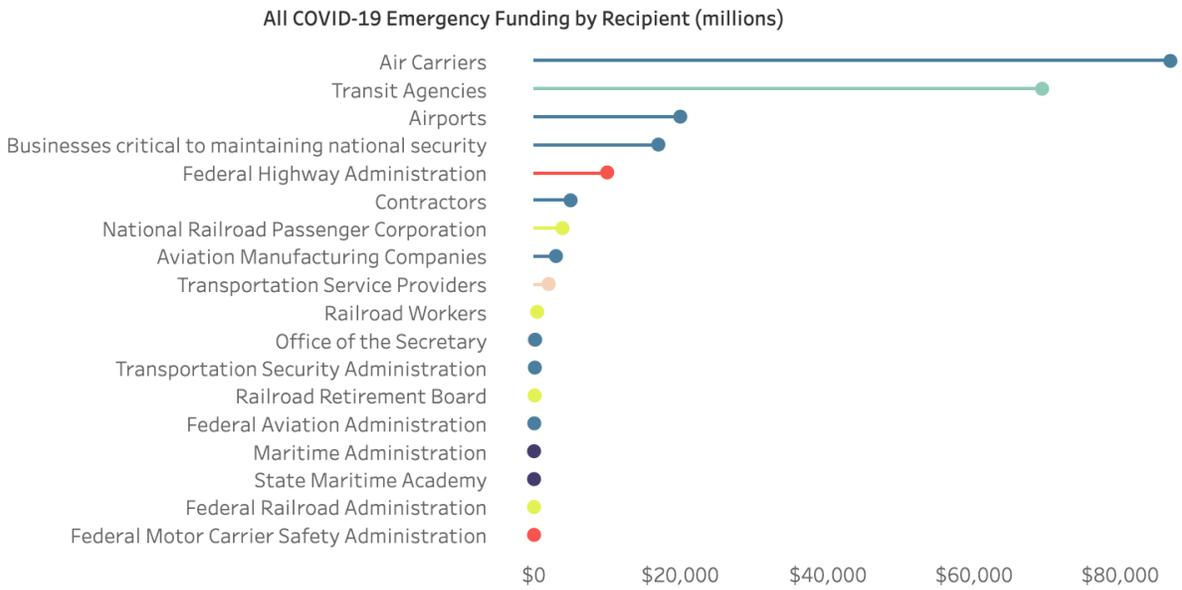


Figure 3: COVID-19 Emergency Funding by Recipient

What is clear is that the disruptions in the aviation industry continue with COVID-19-related employment losses, high demand due to rebound travelers, and an increasing demand for instant product availability. Demand for passenger and freight aviation services continues to recover reflecting the importance of the aviation mode in both of these systems.

3. FACTORS FOR AIR CARGO IN THE MAASTO REGION

This chapter provides an overview of air cargo facilities specifically pertaining to the ten-state MAASTO region.

MAASTO Population Trends as a Freight Factor

Population trends have a direct relationship with the regional economy and in turn, air freight movement and demand. Table 3 shows the population change over the past two decades (from 2000 to 2021) for each of the ten MAASTO states, and overall, for the region. Over the 21-year period, the regional population has grown from 65,326,238 in 2000 to 69,716,822 in 2021, an overall 21-year regional growth of 6.7 percent. Minnesota saw the maximum increase at 16 percent, with Michigan growing the least at 1.1 percent. Minnesota, Indiana, Kentucky, and Missouri have all grown by more than 10 percent, with Wisconsin slightly lower at 9.9 percent.

Table 3: Population by State, MAASTO States, 2000-2021

State Name	U.S. Census			Change		
	2000	2010	2021	2000-2010	2010-2021	2000-2021
Illinois	12,419,293	12,830,632	12,671,469	3.3%	-1.2%	2.0%
Indiana	6,080,485	6,483,802	6,805,985	6.6%	5.0%	11.9%
Iowa	2,926,324	3,046,355	3,193,079	4.1%	4.8%	9.1%
Kansas	2,688,418	2,853,118	2,934,582	6.1%	2.9%	9.2%
Kentucky	4,041,769	4,339,367	4,509,394	7.4%	3.9%	11.6%
Michigan	9,938,444	9,883,640	10,050,811	-0.6%	1.7%	1.1%
Minnesota	4,919,479	5,303,925	5,707,390	7.8%	7.6%	16.0%
Missouri	5,595,211	5,988,927	6,168,187	7.0%	3.0%	10.2%
Ohio	11,353,140	11,536,504	11,780,017	1.6%	2.1%	3.8%
Wisconsin	5,363,675	5,686,986	5,895,908	6.0%	3.7%	9.9%
Total MAASTO	65,326,238	67,953,256	69,716,822	4.0%	2.6%	6.7%
Source: United States Census Bureau						

State GDP and population have a strong, logical correlation. The air cargo industry does not follow the same trends geographically due to the progression toward hub operation implementations by the large air carriers. Decisions by these companies have resulted in more drastic percentage changes in air cargo activity in certain states when compared to the more consistent increases in population across time. As such, these numbers are more representative of potential air cargo demand as produced by the industrial, manufacturing, and population composition of any given state, not any state's viability to host hub operations.

MAASTO Region Transportation Infrastructure

The MAASTO region historically has served as an essential component of American freight infrastructure. The region maintains and operates significant facilities accommodating all modes of freight transportation. Figure 4 shows an overview of freight infrastructure throughout the region.

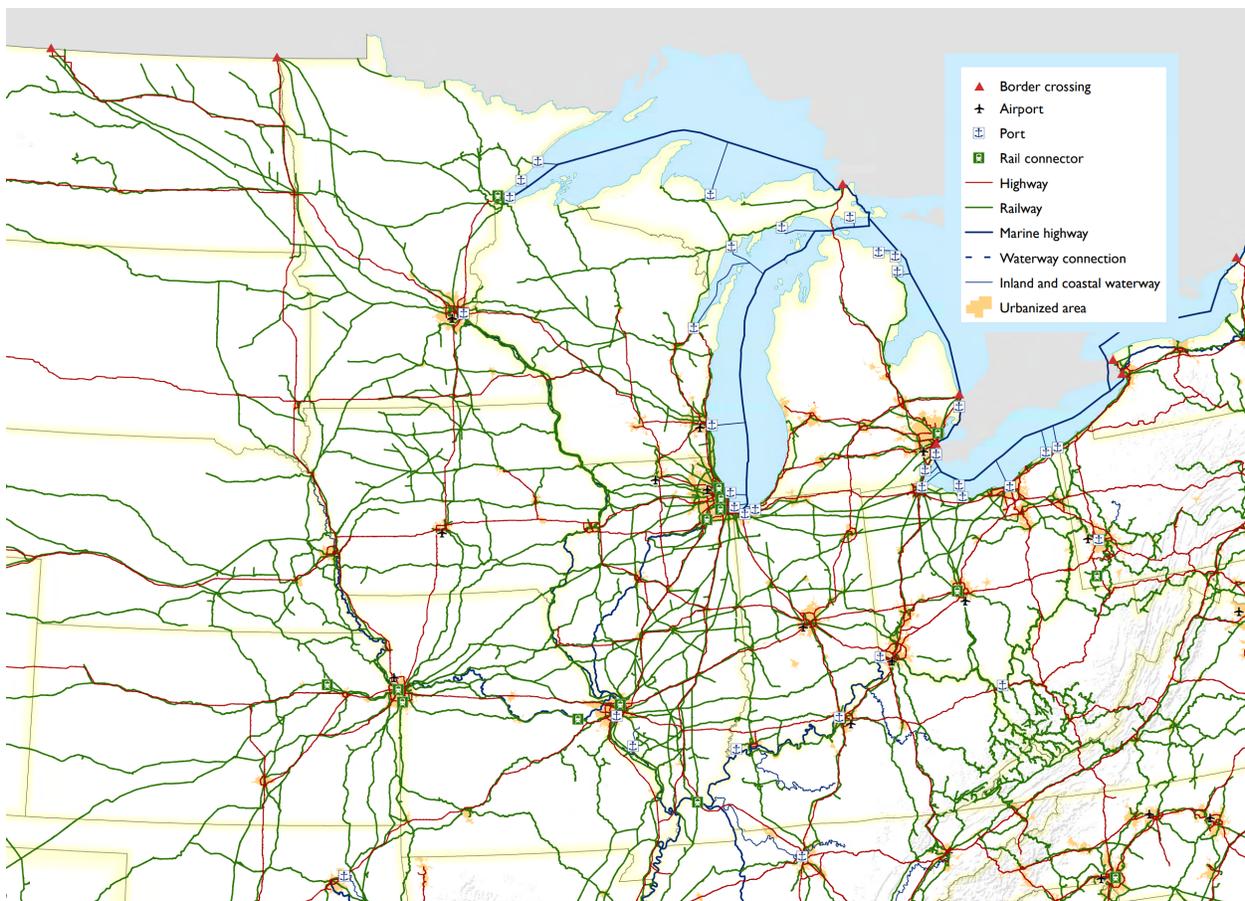


Figure 4: Existing Transportation Infrastructure in MAASTO Region [USDOT Interim National Multimodal Freight Network Map [9]]

The region contains rail lines from all eight Class I railroads. The interstate highway system is extensive. Figure 4 illustrates there are no major coverage issues in freight connectivity throughout the region. Many areas contain the potential for significant intermodal possibilities.

MAASTO Region Airports

Airports included in the NPIAS are classified as commercial service (including category codes P for primary and CS for nonprimary), reliever airports (category code R), and general aviation airports (category code GA). Primary airports are defined as public airports receiving scheduled air carrier service with 10,000 or more enplaned passengers per year. Commercial service airports are defined as any airport with scheduled passenger service with 2,500 or more enplaned passengers per year. Commercial service airports are further classified as large hub, medium hub, small hub, and non-hub airports based on the number of annual passenger enplanements. Reliever airports are specialized high-capacity airports typically located in major metropolitan areas that serve general aviation access. General aviation airports are smaller airports that do not meet the criteria for commercial or reliever classification.

Table 4 shows the number of commercial, reliever, and general aviation airports in the MAASTO states. A total of 815 airports in the MAASTO region are included in the NPIAS. This table does not include heliports, seaplane bases, and military airports. Out of these 815 airports, 673 are classified as General Aviation airports, 86 as Commercial airports, and 56 as Reliever airports.

Table 4: Number of MAASTO-Region Airports by NPIAS Classification

State	Commercial	Reliever	General Aviation	Total
Illinois	12	9	62	83
Indiana	4	7	54	65
Iowa	8	1	70	79
Kansas	8	4	68	80
Kentucky	5	1	49	55
Michigan	17	8	70	95
Minnesota	9	7	81	97
Missouri	8	5	62	75
Ohio	7	8	84	99
Wisconsin	8	6	73	87
Total MAASTO	86	56	673	815

4. MAASTO AIR CARGO ACTIVITY - WEIGHT

This chapter provides an analysis of the air cargo activity in the ten-state MAASTO region focusing specifically on air cargo activity by weight. All data analyzed in this chapter was extracted from the “**Air Carrier Statistics**” database, published by the U.S. Department of Transportation’s Bureau of Transportation Statistics (BTS), hosted through TranStats [10]. TranStats is a BTS tool that provides a one-stop access point for intermodal transportation data for research use.

The Air Carrier Statistics database, also known as the **T-100 data bank**, reports data on the number of passengers and the total tonnage of freight and mail transported by large, certified air carriers with **annual operating revenues of \$20 million or more** [11]. This data set represents a nearly 100 percent census of all carrier flights, as opposed to being derived from random samples and surveys. As such, it is the most widely used, accurate and reliable publicly-available data set on air cargo activity by weight. FAA also reports passenger boarding and all-cargo data at major airports [12]. This data is also compiled primarily using the Form 41 Schedule T-100 Air Carrier Statistics data but also consists of additional sources such as an FAA conducted annual survey of air taxi/commercial operators reporting nonscheduled activity on FAA Form 1800-31, Airport Activity Survey. The FAA collected data thus has better representation from its non T-100 sources, but is not detailed in reporting, only reporting enplaned and landed total tonnage at major airports.

The analysis presented in the chapter includes regionwide analysis for the MAASTO region, state-level analysis for the ten MAASTO states, airport-level analysis, and route-level analysis between airport origin and destination pairs.

The scope of the T-100 data includes “non-stop segment” and “on-flight market” data, with data filtered by:

- U.S. Carriers only,
- All Carriers,

and by:

- Domestic market (origin and destination within US),
- International market (either origin or destination outside of US), and
- All market (origin or destination or both within US).

Non-stop Segment data refers to every revenue flight between two points and the number of passengers, freight, and mail carried on these flights, including diversions and emergency landings. **On-flight Market** data are the number of passengers, freight, and mail carried between two points regardless of the number of stops made by the aircraft. Markets are defined by a flight number; that is to say, if the flight number assigned to a particular aircraft changes, a new market will begin. The On-flight Market data are primarily presented in this chapter because it provides a more accurate picture of air cargo activity attributed to a geographic region (i.e., state or airport).

Region-Wide Analysis

Table 5 shows the total air cargo activity in the 10-state MAASTO region for the calendar year 2021. In 2021, a total of 10,980,294 tons of air cargo (freight plus mail) were enplaned or landed at airports in the MAASTO region. This amount represented approximately 25 percent of the total amount of air cargo enplaned or landed at all U.S. airports in 2021, a substantially larger share than MAASTO's geographical share of the U.S.

Of the total air cargo activity in the MAASTO region, a slightly greater amount of cargo (approximately 5.72 million tons) was landed or had a destination at a MAASTO airport - than was enplaned or originated at a MAASTO airport (approximately 5.57 million tons).

Total air cargo tonnage is divided into two components. Mail is comprised of all mail for which transportation by air is provided, including domestic and foreign mail. Freight includes all property other than mail and passenger baggage that is transported by air. On a tonnage basis, mail represented 316,637 tons, or approximately 2.9 percent (up from 2.5 percent in 2010), of all air cargo activity in the MAASTO region. Mail represented approximately 3.2 percent of all U.S. air cargo activity by weight in 2021. Due to mail comprising such a minor amount of total air cargo activity in the MAASTO region and the U.S. as a whole, the remainder of this chapter will report on air cargo activity as the total of freight plus mail tonnage without regard to the variation in the amount of mail that might be evident in particular geographic levels. Enplaned air cargo represented a 47.9 percent share of the total air cargo activity within the MAASTO region by weight in comparison to the 46.5 percent share across U.S. This shows that import of cargo has a slightly larger share than export at both geographical resolutions.

Table 5: Total Air Cargo Activity in MAASTO Region, 2021

	MAASTO (tons)	Tot U.S. (tons)	MAASTO Share
Enplaned Freight	5,097,399	19,457,720	26.2%
Enplaned Mail	164,307	712,358	23.1%
Total Enplaned Cargo	5,261,706	20,170,077	26.1%
Landed Freight	5,566,258	22,502,646	24.7%
Landed Mail	152,330	695,610	21.9%
Total Landed Cargo	5,718,588	23,198,256	24.7%
Total Mail	316,637	1,407,968	22.5%
Total Air Cargo	10,980,294	43,368,333	25.3%
Percent Enplaned	47.9%	46.5%	
Percent Mail	2.9%	3.2%	

Figure 5 shows the trend in total air cargo tonnage activity in the 10-state MAASTO region from 1990 to 2021. The figure shows the changes in total MAASTO air cargo tonnage, total U.S. air cargo tonnage, and MAASTO's share of total U.S. activity over the period. Over the 21-year period, the total MAASTO region air cargo activity grew from 1.71 million tons in 1990 to nearly 10.98 million tons in 2021, while total tonnage across the U.S. increased from 10.54 million tons in 1990 to 43.37 million tons in 2021. MAASTO region's share of total U.S. activity changed from 16.19 percent in 1990 to 25.32 percent in 2021. A majority of this increase in MAASTO's share came around 2000 – 2005, around the time of the opening of major air cargo hubs in the MAASTO region.

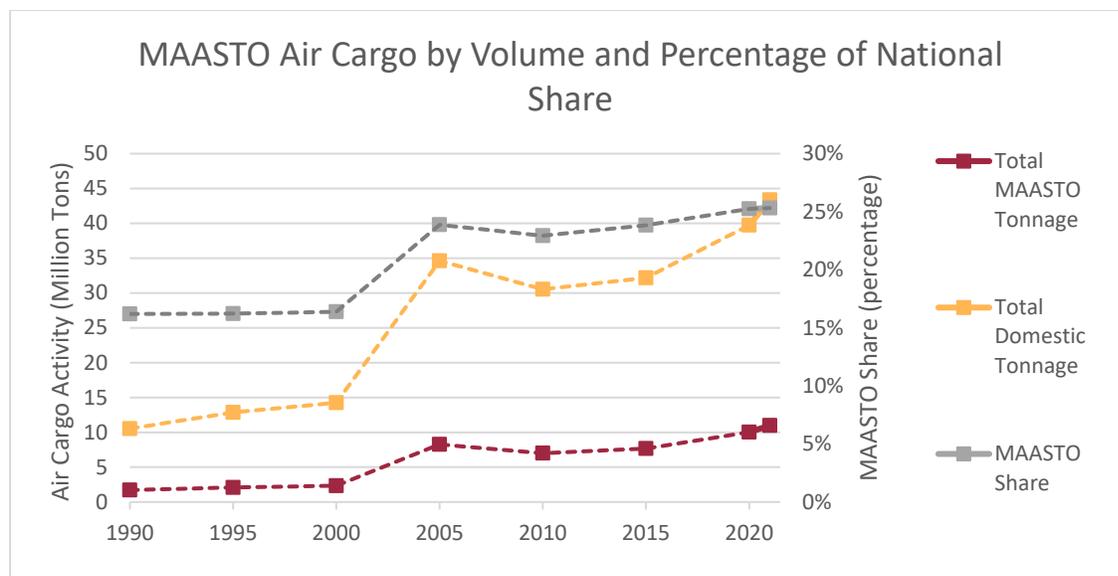


Figure 5: Air Cargo Activity in the MAASTO Region, 1990-2021

From Figure 5, we see that air cargo activity was relatively small from 1990 to 2000. This was followed by a rapid growth seen between 2000 and 2005 and a decline between 2005 and 2010. The period from 2010 to 2020 once again saw growth in air cargo movement.

State-Level Analysis

Table 6 shows the total air cargo activity for each of the 10 states in the MAASTO region for the year 2021, the share of the total activity accounted for by each state and a comparison of the 2021 activity to the 2010 activity. More than 5.1 million tons of air cargo (over 46 percent of all MAASTO region activity) were either enplaned or landed in Kentucky. Kentucky is the home to Louisville International Airport (SDF), which is the main hub and processing center for UPS Airlines, as well as to the Cincinnati/Norther Kentucky International Airport (CVG), which also acts as a hub for DHL. Kentucky saw an 82 percent increase in total activity from 2010 to 2021, the largest increase among the MAASTO states over that time period. Additionally, Amazon recently constructed their \$1.5 billion terminal at CVG in August of 2021, expected to support a fleet of more than 100 Prime Air cargo planes. The new addition is expected to rapidly increase cargo activity within the state ever further at a rapid rate over the coming years. Illinois also saw a

substantial increase at 67 percent between 2010 and 2021, while the growth seen in other states was consistent with, or lower than overall nationwide growth seen in the period.

Table 6: Air Cargo Activity in MAASTO States, 2021

MAASTO States	Enplaned Tons	Landed Tons	Total Tons	MAASTO Share	2010 Total	Incr vs 2010
KY	2,624,531	2,482,461	5,106,992	46.51%	2,803,112	82%
IL	1,201,838	1,712,748	2,914,586	26.55%	1,749,541	67%
IN	693,074	652,573	1,345,647	12.26%	1,056,153	27%
OH	245,929	278,770	524,699	4.78%	394,470	33%
MI	126,419	174,010	300,429	2.74%	284,950	5%
MN	121,853	145,199	267,052	2.43%	256,111	4%
MO	131,063	134,958	266,022	2.42%	202,473	31%
WI	56,782	64,123	120,905	1.10%	115,834	4%
IA	43,955	52,490	96,445	0.88%	110,742	-13%
KS	16,261	20,545	36,806	0.34%	29,011	27%
Total MAASTO	5,261,706	5,717,877	10,979,583	100%	7,002,397	57%

Illinois contributes to another 26.5 percent share of the MAASTO region’s air freight volume, accounting for more than 2.9 million tons. Illinois is home to the second largest airport in the region (Chicago O’Hare International Airport), a major hub for international cargo flights, as well as a secondary hub for UPS in Rockford (Chicago – Rockford International Airport). Together these two states contributed approximately 73 percent of the MAASTO region’s total tonnage. These states also saw the largest increase in volume from 2010 to 2021, leading to an overall increase of 57 percent across the region compared to 2010. Indiana was the third largest state in terms of total air cargo activity in the region, driven by the secondary FedEx hub at Indianapolis, with almost 3 million tons handled, roughly 12 percent share of the region total.

In comparing enplaned tonnage versus landed tonnage, Kentucky and Indiana were the only states that had larger air cargo tonnage enplaned. Illinois, Ohio, Michigan, Minnesota, Missouri, Wisconsin, Iowa, and Kansas all had larger tonnage landed than enplaned.

Table 7 and Table 8 show air cargo activity by state between 2000 and 2021 and annual growth in air cargo activity by state for the same period, divided into 5-year sub-periods, plus 2021. The 21-year period saw air cargo activity at MAASTO airports grow at an annualized rate of 7.7

percent. The largest growth happened in Indiana and Kentucky, with these states seeing 15.4 percent and 15.5 percent annualized growth respectively, driven by the opening of air cargo hub airports in those states. The greatest growth periods happened between 2000 and 2005 across all 10 states, with Indiana seeing a massive 79.2 percent growth, and Iowa, Kentucky, and Ohio all experiencing more than 50 percent growth.

Table 7: Air Cargo Activity from 2000 to 2021 by State (in Tons)

MAASTO States	2000	2005	2010	2015	2020	2021
IA	14,805	137,797	110,742	117,515	94,834	96,445
IL	1,204,086	2,119,154	1,749,541	1,848,864	2,495,020	2,914,586
IN	67,055	1,239,014	1,056,153	1,082,389	1,135,602	1,345,647
KS	7,141	37,871	29,011	30,948	37,112	36,806
KY	248,157	2,276,143	2,803,112	3,427,647	4,958,265	5,106,992
MI	224,908	328,834	284,950	309,642	287,132	300,429
MN	180,083	329,863	256,111	259,567	237,100	267,052
MO	185,722	293,123	202,473	212,550	218,238	266,022
OH	167,625	1,385,410	394,470	252,781	447,022	524,699
WI	34,859	119,105	115,834	127,965	120,236	120,905
Total MAASTO	2,334,442	8,266,313	7,002,397	7,669,868	10,030,561	10,979,583
Total USA	14,250,448	34,618,531	30,533,003	32,172,087	39,726,012	43,368,333
MAASTO Share	16.4%	23.9%	22.9%	23.8%	25.2%	25.3%

The rapid growth of air cargo volumes between 2000 and 2005 was followed by a period (2005-2010) of moderate decline in the MAASTO region, annualized at 3.3 percent. This was followed by a period of modest growth (1.8 percent annualized) from 2010 to 2015. 2015 to 2020 was a period of continued growth, with the region experiencing a 5.5 percent increase. Not all MAASTO states saw air cargo growth in this period, however. Four states (Iowa, Michigan, Minnesota, and Wisconsin) experienced slight declines in the state air cargo activity during this period. Pandemic-related economic changes contributed to a one-year increase in overall air cargo activity in the region from 2020 to 2021.

Table 8: Annualized Change in Air Cargo Activity by State

MAASTO States	2000 - 2021	2000 - 2005	2005 - 2010	2010 - 2015	2015 - 2020	2020 - 2021
IA	9.3%	56.2%	-4.3%	1.2%	-4.2%	1.7%
IL	4.3%	12.0%	-3.8%	1.1%	6.2%	16.8%
IN	15.4%	79.2%	-3.1%	0.5%	1.0%	18.5%
KS	8.1%	39.6%	-5.2%	1.3%	3.7%	-0.8%
KY	15.5%	55.8%	4.3%	4.1%	7.7%	3.0%
MI	1.4%	7.9%	-2.8%	1.7%	-1.5%	4.6%
MN	1.9%	12.9%	-4.9%	0.3%	-1.8%	12.6%
MO	1.7%	9.6%	-7.1%	1.0%	0.5%	21.9%
OH	5.6%	52.6%	-22.2%	-8.5%	12.1%	17.4%
WI	6.1%	27.9%	-0.6%	2.0%	-1.2%	0.6%
Total MAASTO	7.7%	28.8%	-3.3%	1.8%	5.5%	9.5%
Total USA	5.4%	19.4%	-2.5%	1.1%	4.3%	9.2%

Airport-Level Analysis

Table 9 shows the 10 largest airports in the 10-state MAASTO region by level of air cargo activity handled in 2021. The 10 largest airports, as listed, collectively reported over 10.8 million tons of air cargo enplaned or landed in 2021, approximately a 98.5 percent share of the total air cargo activity in the MAASTO region during the year. The listed top 20 airports in the region include primary and regional hubs for express carriers (e.g., Louisville and Rockford for UPS Airlines, and Indianapolis for FedEx) as well as larger passenger and cargo hubs such as Chicago O’Hare International Airport, Cincinnati/Northern Kentucky International, Minneapolis-St. Paul International, and Detroit Metro Wayne County airports.

Louisville and Chicago O’Hare airports collectively account for 50 percent of total air cargo activity in the region (30.8 percent and 21.6 percent, respectively). Together with Cincinnati and Indianapolis, these top four airports account for over 8.5 million tons of total air cargo activity, more than 75 percent of the regional total. Chicago O’Hare saw noticeably more tonnage landed (over 1.4 million) than enplaned (927,000). Across the remaining top four airports, the enplaned tonnage was larger than landed tonnage.

Table 9: Top 20 Airports in MAASTO Region for Air Cargo Activity, 2021

Rank	Code	Airport Name	Enplaned	Landed	Total Tons	Share
1	SDF	Louisville, KY	1,758,990	1,623,885	3,382,875	30.8%
2	ORD	Chicago, IL	926,925	1,442,299	2,369,224	21.6%
3	CVG	Cincinnati/N Kentucky, OH	865,389	858,372	1,723,761	15.7%
4	IND	Indianapolis, IN	667,163	628,704	1,295,867	11.8%
5	RFD	Rockford, IL	250,871	244,273	495,145	4.5%
6	MSP	Minneapolis, MN	113,906	138,061	251,967	2.3%
7	DTW	Detroit, MI	85,189	120,115	205,304	1.9%
8	ILN	Wilmington, OH	141,368	114,953	256,321	2.3%
9	LCK	Columbus, OH	47,561	100,980	148,541	1.4%
10	STL	St. Louis, MO	56,111	63,330	119,442	1.1%
11	MCI	Kansas City, MO	66,512	59,443	125,956	1.1%
12	CLE	Cleveland, OH	44,622	50,733	95,355	0.9%
13	MKE	Milwaukee, WI	38,609	44,489	83,098	0.8%
14	CID	Cedar Rapids/Iowa City, IA	26,319	31,579	57,897	0.5%
15	GRR	Grand Rapids, MI	21,419	24,120	45,539	0.4%
16	DSM	Des Moines, IA	17,634	20,886	38,520	0.4%
17	ICT	Wichita, KS	14,236	18,959	33,195	0.3%
18	LAN	Lansing, MI	10,901	18,328	29,230	0.3%
19	FWA	Fort Wayne, IN	13,336	15,210	28,546	0.3%
20	MSN	Madison, WI	13,146	13,750	26,896	0.2%
Total Top 20			5,180,208	5,632,469	10,812,677	98.5%
Total Remaining			81,497	85,408	166,905	1.5%
Total All			5,261,706	5,717,877	10,979,583	100.0%

Air Cargo Movement Patterns

The movement patterns for air cargo in the MAASTO region are analyzed next. The T-100 database includes details of the air carrier and the origin and destination market for air cargo.

Airline Analysis

Airline data in the T-100 database lists a classification for each flight into one of four service classes based on whether the flight is operating based on a published flight schedule (“scheduled” or “non-scheduled”) and the aircraft’s configuration (“passenger/cargo” where the airline carries for passengers and cargo, or “all cargo” when there are no passengers on the flight). In 2021, air cargo transported on Scheduled flights accounted for approximately 77 percent of MAASTO air cargo activity, with the remaining 23 percent transported on Non-scheduled flights.

Table 10 reports the air cargo activity to and from MAASTO region airports for each of the four service class categories based on the category codes:

- F: Scheduled Passenger/Cargo,
- G: Scheduled All Cargo,
- L: Non-scheduled Passenger/Cargo,
- P: Non-scheduled All Cargo.

The table shows that almost 95 percent of air cargo tonnage activity at airports in the MAASTO region is handled on flights marked under the two “All Cargo” service classes (Scheduled and Non-Scheduled). Nearly 72 percent of all MAASTO air cargo activity is attributed to flights marked as Scheduled All Cargo service classification. This includes most cargo transported by express carriers and all-cargo airlines. In 2021, air cargo transported on Scheduled flights accounted for approximately 77 percent of MAASTO air cargo activity, with the remaining 23 percent transported on Non-scheduled flights.

Table 10: Air Cargo Activity in MAASTO States by Airline Service Class, 2021

Service Class	Enplaned	Landed	Total	Share
Scheduled Passenger/Cargo	225,160	339,712	564,871	5.1%
Scheduled All Cargo	3,913,359	3,983,704	7,897,063	71.9%
Non-scheduled Passenger/Cargo	21,276	19,314	40,591	0.4%
Non-Scheduled All Cargo	1,101,911	1,374,827	2,476,738	22.6%
Total All Service Classes	5,261,706	5,717,557	10,979,263	100%
Percent Scheduled	78.7%	75.6%	77.1%	
Percent All Cargo	95.3%	93.7%	94.5%	

Table 11 shows the top 20 air carriers serving the MAASTO region, based on total air cargo tonnage in 2021. These largest 20 air carriers combined accounted for approximately 90 percent of the total air cargo activity in the region, comprising over 5 million tons of air cargo landed within the region, and nearly 4.8 million tons enplaned within the region. The leading two carriers in the region were the express package and cargo airlines, United Parcel Service (UPS) and Federal Express Corporation (FedEx). In 2021, UPS accounted for 37.2 percent of air cargo activity by weight, while FedEx accounted for 19.8 percent of air cargo. As mentioned earlier, UPS's share is attributed mainly to its major hub in Louisville, KY and secondary hub in Rockford, IL.

The remainder of the top 20 airlines consist mainly of domestic and international all-cargo airlines. These cargo-only airlines contributed another 26 percent share of the total air cargo activity in the region in 2021. A number of these all-cargo air carriers operate for larger, more recognized cargo airlines (such as Atlas, Kalitta and Polar Air operating carriers for DHL, and Atlas, Air Transport, ABX and Cargojet operating carriers for Amazon). Passenger and cargo mixed airlines, including United Air Lines and Delta Air Lines, comprised approximately 2.5 percent of the region's air cargo activity in 2021 compared to 9.4 percent in 2010. This share was significantly reduced by the impacts of the COVID-19 pandemic. The remainder nearly 2.8 percent share of the activity was through international passenger and cargo airlines including Korean Air Lines, China Southern Airlines, and Cathay Pacific Airways.

Airlines not listed in the top 20 in Table 11 that carried air cargo in the region in 2021 also include international passenger airlines transporting cargo in the belly of inter-continental flights, domestic passenger airlines with less presence within the region, regional carriers that operate passenger flights as feeder to major hubs in the region, and regional cargo airlines that have smaller-scale operations and carry smaller loads.

Routes Analysis

In this section, we analyze air cargo routes focusing on three geographic categories:

- Intra-MAASTO Routes – Domestic air cargo routes between airports within the MAASTO region (cargo is enplaned as well as landed at MAASTO airports)
- Domestic USA (Non-MAASTO) Routes – Domestic air cargo routes between an airport within the MAASTO region and a U.S. airport outside of the 10-state MAASTO region (i.e., cargo is enplaned at an MAASTO airport and landed at a non-MAASTO, U.S. airport, or the other way around).
- International Routes – International air cargo routes between an airport within the MAASTO region and an international airport outside of the U.S. (i.e., cargo is enplaned/landed at a MAASTO airport and landed/enplaned at an airport outside of US)

Table 11: Top 20 Air Carriers in MAASTO Region for Air Cargo Activity (by Tonnage and Share), 2021

Rank	Air Carrier	Enplaned	Landed	Total	Share
1	United Parcel Service	2,108,615	1,978,402	4,087,017	37.2%
2	Federal Express Corporation	1,088,437	1,083,381	2,171,818	19.8%
3	Atlas Air Inc.	268,703	349,863	618,566	5.6%
4	Air Transport International	244,070	214,570	458,640	4.2%
5	Kalitta Air LLC	154,931	238,385	393,317	3.6%
6	Polar Air Cargo Airways	164,408	176,611	341,019	3.1%
7	ABX Air Inc	148,540	130,760	279,300	2.5%
8	United Air Lines Inc.	64,262	112,864	177,126	1.6%
9	Southern Air Inc.	68,141	84,728	152,869	1.4%
10	Cargojet Airways Ltd.	85,995	66,498	152,494	1.4%
11	AeroLogic GmbH	60,220	87,339	147,559	1.3%
12	Cargolux Airlines International S.A	60,009	84,922	144,931	1.3%
13	Korean Air Lines Co. Ltd.	25,777	94,270	120,047	1.1%
14	China Southern Airlines	34,810	66,250	101,060	0.9%
15	Nippon Cargo Airlines	40,707	60,316	101,022	0.9%
16	All Nippon Airways Co.	33,740	64,514	98,253	0.9%
17	Eva Airways Corporation	34,076	56,204	90,280	0.8%
18	Delta Air Lines Inc.	38,813	50,768	89,581	0.8%
19	Cathay Pacific Airways Ltd.	29,464	52,791	82,254	0.7%
20	Amerijet International	43,467	32,575	76,042	0.7%
Total Top 20		4,797,184	5,086,011	9,883,196	90.0%
Total All		5,261,706	5,717,877	10,979,583	100.0%

Table 12: Top 20 Intra-MAASTO Air Cargo Routes (by Tonnage), 2021

Rank	Route	Total Activity	Share
1	Louisville, KY-Chicago, IL	55,083	7.6%
2	Louisville, KY-Minneapolis, MN	52,583	7.3%
3	Louisville, KY-Detroit, MI	28,463	3.9%
4	Indianapolis, IN-Minneapolis, MN	27,763	3.8%
5	Cincinnati, OH-Chicago, IL	26,901	3.7%
6	Indianapolis, IN-Chicago, IL	25,501	3.5%
7	Louisville, KY-Milwaukee, WI	24,291	3.4%
8	Indianapolis, IN-Detroit, MI	22,447	3.1%
9	Louisville, KY-Cleveland, OH	22,232	3.1%
10	Louisville, KY-Lansing, MI	22,017	3.0%
11	Louisville, KY-Rockford, IL	21,800	3.0%
12	Kansas City, MO-Louisville, KY	19,971	2.8%
13	Louisville, KY-Cedar Rapids/Iowa City, IA	18,646	2.6%
14	St. Louis, MO-Cincinnati, OH	17,664	2.4%
15	Indianapolis, IN-Cleveland, OH	16,523	2.3%
16	Louisville, KY-St. Louis, MO	16,322	2.3%
17	Indianapolis, IN-Milwaukee, WI	16,189	2.2%
18	Rockford, IL-Minneapolis, MN	14,275	2.0%
19	Louisville, KY-Columbus, OH	14,095	1.9%
20	Kansas City, MO-Indianapolis, IN	13,864	1.9%
Total Top 20 Routes		476,631	65.9%
Total All Intra-MAASTO Routes		723,536	100.0%

Table 13: Top 20 Domestic Air Cargo Routes to/from MAASTO Airports (by Tons and Share), 2021

Rank	Route	Total Activity	Share
1	Louisville, KY-Anchorage, AK	387,826	5.7%
2	Chicago, IL-Anchorage, AK	253,229	3.7%
3	Cincinnati, OH-Anchorage, AK	180,474	2.7%
4	Louisville, KY-Dallas/Fort Worth, TX	124,300	1.8%
5	Louisville, KY-Ontario, CA	120,160	1.8%
6	Cincinnati, OH-Miami, FL	112,739	1.7%
7	Louisville, KY-Philadelphia, PA	108,916	1.6%
8	Louisville, KY-Newark, NJ	106,928	1.6%
9	Louisville, KY-Miami, FL	83,825	1.2%
10	Indianapolis, IN-Memphis, TN	82,655	1.2%
11	Chicago, IL-Memphis, TN	81,792	1.2%
12	Cincinnati, OH-Atlanta, GA	79,460	1.2%
13	Cincinnati, OH-Dallas/Fort Worth, TX	75,568	1.1%
14	Louisville, KY-Oakland, CA	75,207	1.1%
15	Cincinnati, OH-Los Angeles, CA	74,499	1.1%
16	Indianapolis, IN-Los Angeles, CA	71,067	1.0%
17	Louisville, KY-Phoenix, AZ	69,890	1.0%
18	Minneapolis, MN-Memphis, TN	64,203	0.9%
19	Louisville, KY-Seattle, WA	64,040	0.9%
20	Indianapolis, IN-Oakland, CA	63,763	0.9%
Total Top 20 Routes		2,280,541	33.7%
Total All Domestic (Non-MAASTO) Routes		6,773,856	100.0%

Table 12 shows the top 20 intra-MAASTO routes by air cargo tonnage for 2021. A total of 723,536 tons of air cargo was transported between airports within the 10-state MAASTO region (enplaned and landed at MAASTO airports). This corresponds to a little over 7 percent of total MAASTO activity, accounting for all geographic route divisions.

The top 20 routes accounted for 476,631 tons, or approximately 66 percent of all intra-MAASTO air cargo activity. Out of the top 20 routes, 10 involved Louisville as the source or the destination, while three involved Chicago. The only route in the top 20 pairings that did not involve one of the largest four airports (Louisville, Chicago, Indianapolis, or Cincinnati) was the Rockford – Minneapolis route, which ranked 18.

Table 13 shows a total of 6,773,856 tons of air cargo was transported between airports in the MAASTO region and airports within the U.S. outside of the MAASTO region. The table identifies the top 20 domestic air cargo routes that involved a MAASTO airport and a U.S. airport outside of the MAASTO region. These top 20 routes reported 2,280,541 tons of activity, roughly a third of all qualifying routes for the geographic category. This is an identical share as was reported in 2010.

The table shows that Anchorage, AK is the major hub for air cargo transported between North America and Asia, with the top 3 routes listed being between Anchorage and three major airports in the MAASTO region (Louisville, Chicago, and Cincinnati). The top 20 routes listed are typically comprised of major U.S. airports connecting to a major cargo hub in MAASTO, including nine routes that connect to the UPS hub in Louisville.

Table 14: Top 10 Non-MAASTO States with activity to/from MAASTO Region, 2021

Rank	State	Total Activity (Tonnage)
1	California	1,080,077
2	Alaska	907,872
3	Tennessee	760,596
4	Texas	698,188
5	Florida	506,873
6	Pennsylvania	320,961
7	New York	242,036
8	Georgia	229,088
9	New Jersey	215,450
10	Washington	212,598

Table 14 further lists the top 10 U.S. states that contribute to the highest tonnage of air cargo activity with the MAASTO region. California and Alaska contribute as the 2 largest states for air cargo activity with the region, followed by Tennessee, Texas, and Florida, with Pennsylvania, New York, Georgia, New Jersey and Washington finishing in the top 10.

In 2021, a total of 2,759,367 tons of air cargo was transported between airports in the MAASTO region and airports outside of the US. Table 15 shows the top 10 countries, along with the total air cargo activity between that country and an airport in the MAASTO region. Of the roughly 2.76 million tons transported between an international airport and a MAASTO region airport, Germany and Japan accounted for over 400,000 tons each. China, South Korea, and Canada are the three next-highest volume countries by tons of air cargo activity.

In evaluating top international air cargo corridors connecting to the MAASTO region, Table 16 displays the total air cargo activity for the top 20 international air cargo routes between MAASTO airports and airports located outside the US. The top 20 routes reported 1.827 million tons of air cargo activity, attributing to roughly two-thirds of the total 2.76 million tons of international air cargo activity. International air cargo activity between Chicago and major cities in Asia and Europe accounted for 13 of the top 20 routes, including the top 4 overall routes (Tokyo, Shanghai, Seoul, and Frankfurt), ranging from 8.8 percent to 5.2 percent share of the total international air cargo activity. Chicago’s strong presence on the list can be attributed to O’Hare being a major hub for all-cargo airline flights.

Table 15: Top 10 Countries with activity to/from MAASTO Region, 2021

Rank	Country	Total Tonnage
1	Germany	406,036
2	Japan	403,453
3	China	306,160
4	South Korea	254,169
5	Canada	189,433
6	Hong Kong	148,149
7	United Kingdom	120,385
8	France	110,066
9	Mexico	104,954
10	Taiwan	96,417

Table 16: Top 20 International Air Cargo Routes to/from MAASTO Airports, 2021

Rank	Route	Total Tonnage	Share
1	Chicago, IL / Tokyo, Japan	242,458	8.8%
2	Chicago, IL / Shanghai, China	212,324	7.7%
3	Chicago, IL / Seoul, South Korea	160,340	5.8%
4	Chicago, IL / Frankfurt, Germany	144,705	5.2%
5	Louisville, KY / Cologne, Germany	115,785	4.2%
6	Chicago, IL / Hong Kong, Hong Kong	106,857	3.9%
7	Chicago, IL / Taipei, Taiwan	96,310	3.5%
8	Cincinnati, OH / Leipzig, Germany	91,224	3.3%
9	Cincinnati, OH / Tokyo, Japan	76,835	2.8%
10	Chicago, IL / Luxembourg, Luxembourg	72,890	2.6%
11	Chicago, IL / Amsterdam, Netherlands	68,927	2.5%
12	Chicago, IL / Paris, France	65,687	2.4%
13	Chicago, IL / Dubai, United Arab Emirates	55,572	2.0%
14	Chicago, IL / Baku, Azerbaijan	55,168	2.0%
15	Chicago, IL / London, United Kingdom	54,009	2.0%
16	Cincinnati, OH / Seoul, South Korea	52,260	1.9%
17	Cincinnati, OH / Brussels, Belgium	41,293	1.5%
18	Cincinnati, OH / Nagoya, Japan	40,233	1.5%
19	Chicago, IL / Zhengzhou, China	38,864	1.4%
20	Cincinnati, OH / Hamilton, Canada	35,365	1.3%
Total Top 20 Routes		1,827,107	66.2%
Total All International Routes		2,759,367	100.0%

5. MAASTO AIR CARGO ACTIVITY – VALUE AND COMMODITY

Overview of the Freight Analysis Framework Data

This chapter provides an analysis of the air cargo activities in the region, by value and commodity type, using the Federal Highway Administration Freight Analysis Framework, commonly known as the FAF database. The Freight Analysis Framework 5 (FAF5) dataset is a rich database that integrates multiple publicly available data sources into a single source [13]. FAF5 provides a comprehensive picture of freight movements by all transportation modes among 132 state and major metropolitan regions, and international area zones. Forty-three types of freight commodities are classified at the 2-digit level of the Standard Classification of Transported Goods (SCTG) [14].

Data Challenges

The diversity in the air cargo industry presents several challenges for capturing the full picture of air freight movements comprehensively. Shipments with a great variety of weights and sizes can be shipped via complex all-cargo networks, on small charter services, or as part of commercial mixed (passenger and cargo) air movements. Additionally, most shipments moved by air are done as multimodal movements, where the initial and final connections rely on movement by trucks. FAF5 defines seven modes of transportation from the Commodity Flow Survey (CFS) plus an extra category involving imports. These modes are: 1. Truck; 2. Rail; 3. Water; 4. Air (includes truck-air); 5. Multiple Modes and Mail; 6. Pipeline; 7. Other and Unknown; and 8. No Domestic Mode. Based on the definitions of the modes in FAF5, freight moved by air can fall in the following 2 modes:

- Air (includes truck-air) – Includes shipments moved by air or a combination of truck and air in commercial or private aircraft. Includes air freight and air express. In the case of imports and exports by air, domestic moves by ground to and from the port of entry or exit are categorized with Truck.
- Multiple Modes and Mail – Includes shipments by multiple modes and by parcel delivery services, U.S. Postal Service, or couriers (capped at 150 pounds). This category is not limited to containerized or trailer-on-flatcar shipments.

The inability to decipher air movements clearly and accurately within the “Multiple Modes and Mail” mode leads to a situation where only the shipments identified with mode “Air (includes truck-air)” can be analyzed for this section. As a result, FAF5 analyzed air cargo activity does not provide a full representation of all air cargo movement, unlike data by weight analyzed in the previous chapter.

An additional limitation of the analysis is its inability to capture the full activity required for some air cargo shipments. The FAF5 database lists the ultimate origin and destination of movements, so the intermediate stops at large distribution hubs used by air cargo carriers are not in the FAF database.

Value of the FAF5 and Description of Data Analyzed

The FAF dataset can help to complement the analysis by weight in the previous chapter despite the limitations listed above. Some of the advantages of this analysis are:

- Air cargo movements are broken down by state-wide and major region area origins and destinations
- The FAF5 dataset contains commodity-specific air cargo movements
- The FAF5 database presents the dollar value associated with the air cargo shipments
- FAF5 provides forecasts of future activity to the year 2050

FAF version 5.3 was used for the analysis in this chapter. Released in November 2021, it was the most recent version available at the time of this report. FAF5.3 provides tonnage estimates, value, and ton-miles by origin-destination pair of FAF regions, commodity type, and mode for the base year of 2017, recent years 2018-2019, forecast year estimates for 2020-2050, and state-level historical trend estimates for 1997-2012. The estimate projections for 2020 are used in this analysis.

Table 17: Total U.S. and MAASTO Region Freight Activity (million U.S. dollars) by Mode, 2020

FAF Mode of Transportation	MAASTO Region		U.S. Total	
	Value	%	Value	%
Truck	4,475,624	73.1%	13,547,957	72.5%
Rail	218,532	3.6%	512,153	2.7%
Water	40,063	0.7%	277,792	1.5%
Air (include truck-air)	219,653	3.6%	622,865	3.3%
Multiple modes & mail	907,226	14.8%	2,707,764	14.5%
Pipeline	250,547	4.1%	941,822	5.0%
Other and unknown	7,855	0.1%	39,267	0.2%
No domestic mode	-	0.0%	42,261	0.2%
Total	6,119,500	100%	18,691,881	100%

FAF Overview Analysis

The FAF database is a national database that allows for a comparison of the freight activity in the MAASTO region with the entire U.S. freight activity. FAF5.3 indicates that the total freight originating or terminating in the MAASTO region is valued at approximately \$6.1 trillion, with air cargo contributing \$219 billion, a 3.6 percent share of the total (Table 17). With the total freight originating or terminating in all of the U.S. valued at approximately \$18.7 trillion for all modes, MAASTO’s share of the total is roughly 32.7 percent or almost one-third.

We also see that trucking is the mode of transport with the largest size by valuation at approximately 73 percent for both the U.S. and the MAASTO region. Air movement share of the total movement is 3.6 percent in the MAASTO region, slightly higher than the 3.3 percent in the U.S. Table 17 also indicates that truck, rail, and air modes contribute to a larger share of the total activity in the MAASTO region compared to nationally.

Analyzing freight movement by trade type (Table 18), we see that domestic movements make up approximately 84 percent of all shipments by value in the MAASTO region, compared to 80.4 percent nationally. We can further see that for all air cargo movement in the region, 17.7 percent comes from domestic only trade, roughly 37 percent from exports, and a substantial 45 percent from imports.

Table 18: Total U.S. and MAASTO Region Freight Activity (million U.S. dollars) by Trade Type, 2020

Trade Type	MAASTO Region		U.S. Total	
	% All Modes	% Air	% All Modes	% Air
Domestic	83.8%	17.7%	80.4%	24.9%
Import	9.7%	45.4%	11.5%	38.4%
Export	6.5%	36.9%	8.1%	36.7%
Total	100%	100%	100%	100%

Analyzing the value of freight moved to and from each MAASTO state by air (Table 19), we see that Illinois captures the largest portion of all air cargo activity in the region, with 37.5 percent of all originating cargo and 29 percent of all terminating cargo in the region for a total of \$88 billion in total. Illinois is very closely followed by Kentucky in second at \$87 billion in value of activity, with a 33.2 percent share of the regional total. Illinois and Kentucky together account for over two-thirds of the total activity in the region. Minnesota and Ohio come in 3rd and 4th in total activity, making up approximately another 16.5 percent of the region’s total. Comparing the air cargo mode totals between Table 17 and Table 19, it is revealed that shipments valued at \$42.7 billion (\$262 billion - \$219 billion) originated and terminated within the MAASTO region (and are thus counted for both landed and originated in Table 19).

Table 19: MAASTO State Air Cargo Totals (million U.S. dollars), 2020

MAASTO State	From State		To State		Total	
	Value	% Value	Value	% Value	Value	% Value
Illinois	53,712	37.5%	34,565	29.0%	88,276	33.6%
Indiana	4,118	2.9%	3,566	3.0%	7,684	2.9%
Iowa	2,558	1.8%	1,294	1.1%	3,852	1.5%
Kansas	3,194	2.2%	2,610	2.2%	5,803	2.2%
Kentucky	41,121	28.7%	45,933	38.5%	87,054	33.2%
Michigan	4,968	3.5%	7,057	5.9%	12,024	4.6%
Minnesota	16,728	11.7%	5,707	4.8%	22,435	8.5%
Missouri	2,589	1.8%	2,580	2.2%	5,168	2.0%
Ohio	10,497	7.3%	9,762	8.2%	20,259	7.7%
Wisconsin	3,590	2.5%	6,263	5.2%	9,853	3.8%
Total	143,074	100%	119,335	100%	262,409	100%

As previously mentioned, FAF breaks down the geographical area for some of the most important markets around the country. Nine out of the ten MAASTO states have more than one FAF zones, allowing for finer geographic evaluation of data. Table 20 shows the overall air cargo activities for the 29 FAF zones in the region. There are several instances in the MAASTO region where the major metropolitan area spreads across multiple states. For those instances, FAF splits the zone and distributes the freight activity to separate portions for each state. For the MAASTO region, this happens in Chicago (split into IL, IN, and WI for a total of 3 FAF zones); St Louis (split into IL and MO); Kansas City (split into KS and MO), and Cincinnati (KY and OH). Minneapolis-St Paul is a unique case where the metropolitan area is largely contained within MN but also extends into WI. In this instance, there is a specific FAF zone for the metropolitan area contained within MN, but the WI portion of the metropolitan is relatively smaller and is counted within the “Rest of WI” FAF zone.

Table 20: MAASTO FAF Zone Totals (million U.S. dollars), 2020

State	Zone	Zone Name	From Zone		To Zone		Total	
			Value	% Value	Value	% Value	Value	% Value
IL	171	Chicago IL-IN-WI (IL Part)	52,659	37%	32,595	27%	85,254	32%
	172	St. Louis MO-IL (IL Part)	97	0%	206	0%	302	0%
	179	Rest of IL	956	1%	1,764	1%	2,720	1%
IN	181	Chicago IL-IN-WI (IN Part)	262	0%	290	0%	552	0%
	182	Indianapolis IN	1,956	1%	1,888	2%	3,844	1%
	183	Fort Wayne IN	856	1%	377	0%	1,233	0%
	189	Rest of IN	1,045	1%	1,011	1%	2,056	1%
IA	190	Iowa	2,558	2%	1,294	1%	3,852	1%
KS	201	Kansas City MO-KS (KS Part)	1,764	1%	815	1%	2,579	1%
	202	Wichita KS	680	0%	1,062	1%	1,742	1%
	209	Rest of KS	750	1%	732	1%	1,482	1%
KY	211	Cincinnati OH-KY-IN (KY Part)	2,391	2%	2,769	2%	5,160	2%
	212	Louisville KY-IN (KY Part)	34,410	24%	38,830	33%	73,240	28%
	219	Rest of KY	4,320	3%	4,333	4%	8,653	3%

MI	261	Detroit MI	3,447	2%	5,001	4%	8,448	3%
	262	Grand Rapids MI	544	0%	703	1%	1,247	0%
	269	Rest of MI	977	1%	1,352	1%	2,329	1%
MN	271	Minneapolis-St. Paul MN-WI (MN Part)	15,127	11%	4,765	4%	19,892	8%
	279	Rest of MN	1,601	1%	941	1%	2,543	1%
MO	291	Kansas City MO-KS (MO Part)	634	0%	526	0%	1,160	0%
	292	St. Louis MO-IL (MO Part)	1,377	1%	1,471	1%	2,847	1%
	299	Rest of MO	578	0%	583	0%	1,161	0%
OH	391	Cincinnati OH-KY-IN (OH Part)	1,864	1%	1,810	2%	3,674	1%
	392	Cleveland OH	3,590	3%	3,647	3%	7,237	3%
	393	Columbus OH	2,932	2%	2,267	2%	5,199	2%
	394	Dayton OH	571	0%	540	0%	1,111	0%
	399	Rest of OH	1,540	1%	1,498	1%	3,038	1%
WI	551	Milwaukee WI	1,014	1%	1,793	2%	2,807	1%
	559	Rest of WI	2,576	2%	4,470	4%	7,047	3%
Total			143,074	100%	119,335	100%	262,409	100%

FAF Commodity Analysis

The FAF defines commodities using the 43 two-digit Standard Classification of Transported Goods (SCTG) commodity codes; the classification used in the Commodity Flow Survey (CFS). The CFS also accumulates these commodities into nine broad groups of similar commodities. This section examines air cargo activity by commodity groups and two-digit SCTG code commodities.

Analysis by Commodity Group and Specific Two-Digit SCTG Codes

Table 21 shows the air cargo activity in the MAASTO region for each of the nine commodity groups by value and weight. Commodity group 8: **Electronic, motorized vehicles, and precision instruments**, is the most significantly transported group in the region, accounting for 37.7 percent of all air cargo movement by tonnage, and a substantially large 63.2 percent by value. The wide difference between its share by weight and value is indicative of the goods within this group being high-value, low-weight items. Commodity groups 5: **Pharmaceutical and chemical products**, and Commodity group 7: **Base metal and machinery** come in at the second and third ranks by value at 15.6 percent and 13.6 percent, respectively. The three categories combined account for over 92 percent of all air cargo activity in the region by value and 47.8 percent by weight.

Table 21: MAASTO Air Cargo Shipments by Commodity Groups (million U.S. dollars), 2020

Commodity Group	Value	% Value	Tons	%Tons
1 Agriculture products and fish (SCTG Codes: 01-05)	1,406	0.6%	75	3.7%
2 Grains, alcohol, and tobacco products (SCTG Codes: 06-09)	570	0.3%	65	3.2%
3 Stones, non-metallic minerals, and metallic ores (SCTG Codes: 13-14)	38	0.0%	5	0.3%
4 Coal and petroleum products (SCTG Codes: 19)	23	0.0%	22	1.1%
5 Pharmaceutical and chemical products (SCTG Codes: 20-24)	34,188	15.6%	330	16.0%
6 Logs, wood products, and textile and leather (SCTG Codes: 26-30)	4,372	2.0%	225	10.9%
7 Base metal and machinery (SCTG Codes: 31-34)	29,837	13.6%	429	20.9%
8 Electronic, motorized vehicles, and precision instruments (SCTG Codes: 35-38)	138,710	63.2%	775	37.7%
9 Furniture and miscellaneous manufactured products (SCTG Codes: 39-43)	10,502	4.8%	131	6.4%
Total	219,645	100%	2,058	100%

We next analyze air cargo movement by specific commodities (at the 2-digit SCTG commodity code level). Table 23 lists the top 5 commodities by the value of activity in the region. As expected, **Electronics** contributes the largest portion of the total activity at 42.1 percent at a total value of \$92.5 million. **Precision Instruments, Pharmaceuticals, and Machinery** rank in at the 2nd, 3rd, and 4th positions with 14.5, 11.0, and 10.5 percent shares, respectively. **Transport Equipment** finishes the top 5 with a 5.0 percent contribution. The top 5 commodities together make up nearly 83 percent of all activity. **Miscellaneous Manufacturing Products, Chemical Products, Articles-base Metal, Motorized Vehicles, and Plastics/Rubber** make up the next 5 commodities, with the top 10 commodities' contribution corresponding to \$203.5 million of the total \$219.7 million, or 92.7 percent of the total activity.

Table 22: MAASTO Air Cargo Trade Types by Commodity Group (million U.S. dollars), 2020

Commodity Group	Domestic		Import		Export		Total	
	Value	% Val	Value	% Val	Value	% Val	Value	% Val
1 Agriculture products and fish	49	3.5%	375	26.7%	982	69.9%	1,406	100%
2 Grains, alcohol, and tobacco products	58	10.1%	257	45.0%	256	44.9%	570	100%
3 Stones, non-metallic minerals, and metallic ores	9	22.3%	4	9.1%	26	68.6%	38	100%
4 Coal and petroleum products	7	30.9%	2	9.2%	14	59.9%	23	100%
5 Pharmaceutical and chemical products	4,968	14.5%	14,648	42.8%	14,572	42.6%	34,188	100%
6 Logs, wood products, and textile and leather	954	21.8%	2,142	49.0%	1,276	29.2%	4,372	100%
7 Base metal and machinery	2,169	7.3%	9,793	32.8%	17,875	59.9%	29,837	100%
8 Electronic, motorized vehicles, and precision instruments	28,400	20.5%	66,577	48.0%	43,732	31.5%	138,710	100%
9 Furniture and miscellaneous manufactured products	2,197	20.9%	5,917	56.3%	2,388	22.7%	10,502	100%
Total	38,811	17.7%	99,713	45.4%	81,121	36.9%	219,645	100%

Table 23: Top 5 Air Cargo Commodities (million U.S. dollars), 2020

Rank	Commodity	Value	% Value
1	35 Electronics	92,513	42.1%
2	38 Precision instruments	31,856	14.5%
3	21 Pharmaceuticals	24,095	11.0%
4	34 Machinery	23,082	10.5%
5	37 Transport equip.	11,037	5.0%
Top 5 Total		182,583	83%
Grand Total		219,653	100%

FAF Air Cargo Movement Analysis

In this section, we do an analysis of movements between FAF zones looking at the within MAASTO, US, and international sources (destinations) for movements terminating (originating) in the MAASTO region.

Table 24: Top 10 FAF State Destinations for MAASTO Originating Air Cargo (million U.S. dollars), 2020

Rank	Destination FAF State	Value	% Value
1	6 California	28,966	20.2%
2	804 Europe	14,110	9.9%
3	807 Eastern Asia	10,460	7.3%
4	47 Tennessee	8,744	6.1%
5	803 Rest of Americas	7,360	5.1%
6	21 Kentucky	6,694	4.7%
7	48 Texas	5,275	3.7%
8	34 New Jersey	5,179	3.6%
9	808 SE Asia & Oceania	4,894	3.4%
10	39 Ohio	4,531	3.2%
Top 10 Totals		96,213	67.2%
Grand Total		143,074	100%

Table 24 - Table 27 report the top origins and destinations for air shipments to and from the MAASTO region and the top commodities moved. Table 24 lists the top 10 FAF destinations for MAASTO originating cargo in 2020. California serves as the destination for the largest share of shipments originating in the region by value claiming a 20.2 percent share. International movements to Europe and to Eastern Asia take the second and third spots. In all there are six domestic destinations and four international destinations in the top 10. The top 10 destinations together represent a little more than 67 percent of all commodity value originating from the MAASTO region.

Table 25 shows an overview of the most valued commodities transported from the MAASTO region to the top 2 destinations (California and Europe). Electronics is the single largest commodity shipped to California, at 88.6 percent by value. Electronics is again the highest valued commodity shipped to Europe but contributes to a more modest 24.6 percent share with Machinery coming in second at 18.8 percent.

Table 25: Top Commodities at the Top 2 Destination FAF States (million U.S. dollars), 2020

FAF Zone	Commodities	Value	% Value
6 California	35 Electronics	25,677	88.6%
	38 Precision instruments	1,336	4.6%
	34 Machinery	473	1.6%
	30 Textiles/leather	250	0.9%
	40 Misc. mfg. prods.	225	0.8%
	Top 5 Total	27,962	96.5%
804 Europe	35 Electronics	3,473	24.6%
	34 Machinery	2,658	18.8%
	38 Precision instruments	1,858	13.2%
	21 Pharmaceuticals	1,380	9.8%
	37 Transport equip.	740	5.2%
	Top 5 Total	10,109	71.6%

Table 26 lists the top 10 FAF origins for movements with MAASTO destinations in 2020. Europe, Eastern Asia and California are once again the top 3 locations on the list of originating states. Europe serves as the origin for the largest share of shipments landing in the region by value claiming a 15.4 percent share. Europe is followed by Eastern Asia and California respectively in the second and third spots. Europe and Eastern Asia are the only 2 international locations serving as an origin in the top 10, with the remaining 8 being domestic locations led by California and Texas by value. The top 10 destinations together represent a little more than 61 percent of all commodity value landed in the MAASTO region.

Table 26: Top 10 FAF State Origins for MAASTO Terminating Air Cargo (million U.S. dollars), 2020

Rank	Originating FAF State	Value	% Value
1	804 Europe	18,330	15.4%
2	807 Eastern Asia	12,931	10.8%
3	6 California	9,905	8.3%
4	48 Texas	6,161	5.2%
5	27 Minnesota	5,634	4.7%
6	39 Ohio	5,172	4.3%
7	53 Washington	4,125	3.5%
8	13 Georgia	3,812	3.2%
9	21 Kentucky	3,804	3.2%
10	47 Tennessee	3,222	2.7%
Top 10 Totals		73,096	61.3%
Grand Total		119,335	100%

Table 27 shows an overview of the most valued commodities transported to the MAASTO region from the top 2 origins (Europe and Eastern Asia). Pharmaceuticals are the largest commodity shipped to Europe, forming over a third of all shipments by value transported from Europe. Electronics is the highest valued commodity imported from Eastern Asia contributing to more than 56 percent share of all imports from Eastern Asia.

Table 27: Top Commodities at the Top 2 Origin FAF States (million U.S. dollars), 2020

FAF Zone	Commodities	Value	% Value
804 Europe	21 Pharmaceuticals	6,566	35.8%
	38 Precision instruments	3,204	17.5%
	34 Machinery	2,611	14.2%
	35 Electronics	2,165	11.8%
	37 Transport equip.	746	4.1%
	Top 5 Total	15,292	83.4%
807 Eastern Asia	35 Electronics	7,245	56.0%
	37 Transport equip.	1,484	11.5%
	38 Precision instruments	1,000	7.7%
	34 Machinery	927	7.2%
	21 Pharmaceuticals	580	4.5%
	Top 5 Total	11,235	86.9%

6. CASE STUDY – LOUISVILLE AIRPORT

Louisville Muhammad Ali International Airport (SDF), formerly and commonly known as Louisville International Airport, is a civil-military airport in the city of Louisville in Jefferson County, Kentucky. The airport was originally called Standiford Field, which is where its International Air Transport Association (IATA) airport code SDF comes from. The airport covers 1,500 acres (6.1 km²) of area and has three runways.

Louisville International is home to the worldwide air hub for United Postal Services (UPS), and thus also a major port of entry. The airport is the largest airport in the MAASTO region by air cargo weight handled, and third largest in the U.S. behind Memphis International Airport (MEM) in Memphis, Tennessee, home to FedEx’s SuperHub, and Ted Stevens Anchorage International Airport (ANC). It is also fifth largest by total cargo tonnage with Hong Kong International Airport (HKG), and Shanghai Pudong (PVG) also ahead of it.

Table 28 compares air cargo activity (enplaned and landed) at Louisville International (SDF) by weight, activity in all of Kentucky, and in all of U.S. The table shows that a majority of the total air cargo activity in the state of Kentucky (roughly 5.1 million tons), happens at Louisville airport (3.38 million tons). This corresponds to a 66 percent share of the state’s total. The total activity at Louisville also corresponds to a nearly 8 percent share of all air cargo activity in the U.S. The table also shows that the total weight of cargo enplaned in Louisville is slightly larger than the total tons landed, similar in trend to Kentucky overall.

Table 28: Air Cargo Activity at Louisville compared to the State and U.S. (Tons)

Movement	Type	All U.S.	All Kentucky	SDF / Louisville
Enplaned	Freight	19,295,570	2,522,816	1,660,971
	Mail	712,357	101,715	98,019
	Total	20,007,927	2,624,531	1,758,990
Landed	Freight	22,260,457	2,379,873	1,521,762
	Mail	695,499	102,588	102,123
	Total	22,955,956	2,482,461	1,623,885
Grand Total		42,963,883	5,106,992	3,382,875

The T-100 database also reveals that Louisville has seen a steady growth in tonnage handled (enplaned and landed) over the last 6 years (Figure 6), having grown from 2,552,004 tons in 2015 to 3,382,875 tons in 2021 for an average growth of 4.8 percent annualized. The highest growth was seen between 2019-2020 with an approximately 7 percent growth in the year.

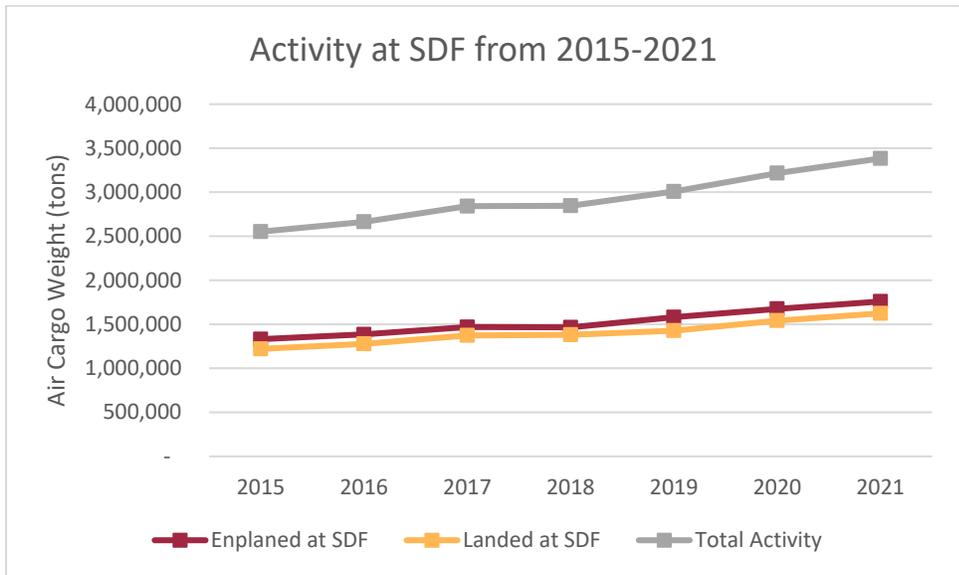


Figure 6: Air Cargo Activity at Louisville over time (2015-2021)

Table 29 lists the top 10 carriers operating at Louisville by tons of air cargo handled (enplaned and landed). Not surprisingly, UPS airlines claims most of the activity (nearly 98 percent of the airport’s total). Half of the remaining 2 percent is attributed to FedEx, with other cargo airlines and Southwest airlines making up the remaining top 8.

Table 29: Top 10 Carriers at Louisville by Weight (Tons)

Carrier	From SDF	To SDF	Total	% All SDF
United Parcel Service	1,724,679	1,589,870	3,314,548	97.98%
Federal Express Corporation	18,352	15,200	33,552	0.99%
Atlas Air Inc.	5,118	5,174	10,292	0.30%
Western Global	3,046	3,805	6,851	0.20%
National Air Cargo Group Inc	1,663	3,470	5,133	0.15%
Sky Lease Cargo	1,919	1,647	3,566	0.11%
Gulf And Caribbean Cargo	1,407	1,515	2,922	0.09%
Kalitta Air LLC	1,420	1,431	2,851	0.08%
Southwest Airlines Co.	434	398	832	0.02%
ABX Air Inc	446	307	753	0.02%

We also analyze the top 10 routes / airport pairs by weight of cargo moved (Table 30). This includes cargo enplaned at Louisville and landed at another airport, and cargo enplaned at another airport and landed at Louisville. A total of 391,102 tons of cargo, a 11.58 percent share of all activity at Louisville was due to movements to/from Anchorage. This is nearly a one-third share of all activity between Louisville and its top 10 airport partners by weight of cargo moved. The remaining nine airport pairs shown in the table make up another 25.7 percent of all activity at Louisville.

Table 30: Top 10 Airports paired with Louisville by Weight (Tons)

Airports Pairs with SDF / Routes		From SDF	To SDF	Total	% All SDF
ANC	Anchorage, AK	87,023	304,079	391,102	11.58%
DFW	Dallas/Fort Worth, TX	62,528	62,525	125,053	3.70%
ONT	Ontario, CA	62,960	54,488	117,449	3.48%
CGN	Cologne, Germany	42,425	73,360	115,785	3.43%
PHL	Philadelphia, PA	59,718	49,941	109,659	3.25%
EWR	Newark, NJ	50,841	56,270	107,111	3.17%
MIA	Miami, FL	52,587	30,757	83,344	2.47%
OAK	Oakland, CA	39,994	35,599	75,593	2.24%
PHX	Phoenix, AZ	37,049	32,278	69,327	2.05%
BFI	Seattle, WA	36,575	28,331	64,906	1.92%

Louisville represents the biggest cargo hub in the MAASTO region for air cargo movement. As the main hub for UPS, Louisville has seen a steady growth over the past few years. This trend is expected to continue as well. It presents an interesting case to study in future continuation work for air freight analysis to see how the growth at Louisville progresses over the years.

Development at SDF demonstrates the critical logistic and economic role that air cargo plays in the MAASTO region. The region's connectedness, its geographic center, workforce availability, and range of multimodal options provides ideal locations for warehousing and distribution.

7. OVERVIEW OF FREIGHT AVIATION ISSUES AND STRATEGIC DEVELOPMENT

Telephone interviews were completed with state DOT aviation leads from the MAASTO region, to assess the integration of aviation planning and programs in the overall agency freight framework, and assess this sector's perspective on strengths, constraints, opportunities, and areas for improvement in their work. This approach is similar to a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis but designed for exploratory and strategic understanding.

The following summary provides a snapshot on the perspectives of these aviation professionals regarding the integration and development of freight aviation across the MAASTO States.

Specific questions addressed include:

- the importance of aviation cargos,
- integration of aviation into freight planning and vice versa,
- strengths, opportunities, concerns, and areas for improvement in the freight aviation area.

The respondents were also asked about trends in air cargo and the future of air cargo.

The Importance of Freight Aviation

The freight, or cargo movement, in the aviation vernacular, is a tremendous asset and economic driver for all the MAASTO states. Not only are the large airports and cargo facilities across the region recognized as important, but all respondents characterized cargo movement in rural areas as critical to the economy. Rural manufacturing is heavily dependent on just-in-time delivery of critical parts, instrumentation, electronics and specialized components, and even hazardous materials.

Work force availability, along with other competitive advantages have drawn manufacturing to locate in rural areas. Without access to cargo services, even on a smaller scale, these developments in manufacturing and distribution facilities would not be possible. Further, while most of aviation was shuttered during COVID, air cargo played a significant role in the delivery of personal protective equipment (PPE) and relief supplies across the US and internationally.

Freight aviation is just a small portion of the overall freight moved across all modes. The respondents recognized that the cargos are generally high value and smaller quantities, and given the urgency and value, air cargo is often the only way to deliver in a timely manner. Kansas indicated that one of their strategic initiatives is to support and grow high value, specialized manufacturing that is linked to high quality, safe, air service in the areas of aviation and agriculture. While the region is replete with major cargo service areas in Kentucky, Ohio, Illinois, and Indiana, the rural systems are an economic foundation for a county or rural region.

Integration of Freight Aviation with Agency Freight Planning and Operations

Across the board respondents indicated little affiliation and integration of aviation freight planning and operations within the agency's overall freight agenda. The relationship and the integration across the documents are characterized by cargo data and budgets, rather than strategic freight goals, planning processes, and operations.

Similarly, the state aviation leads responded that their FAA required state aviation plans normally provide a minor mention of the importance of freight aviation. Again, the assessment is usually limited to documenting cargo tons and value. Still, these are critical facilities and the States do provide airport-by-airport economic impact studies that numerate increased economic activity, employment, and business development linked to activity at the airport.

With the private sector leadership in cargo movement and operations, the aeronautics sections are generally not included in the cargo and logistics planning. Yet, the UPS, FedEx and Amazon air facilities place a tremendous volume of consumer freight on the local and regional infrastructure. Given the challenges in logistics workforce, the traffic impacts from these facilities, and the continued expansion of warehousing and air cargo activity, several respondents expressed that this is a growing freight issue, and they need and want to be more involved.

Freight Aviation Perspectives on Development

The respondents both expressed a desire to know more and play more of role in supporting the freight aviation sector, however noting that they have found it hard to penetrate the sector. Given the successful State Freight Advisory Committees (FACs) across the region, State FACs could support additional development of the freight aviation role in agency freight planning and operations.

The respondents were asked to identify areas of strengths, constraints, opportunities, and areas for improvement for the states and region. The following narrative summarizes these discussions.

Strengths:

Strong multimodal system

As summarized best by an Illinois respondent – we (the MAASTO States and region) have it all. A concentration of the most critical freight corridors or facilities in every mode. Air cargo is a bonus niche.

Rural Connections

Every respondent mentioned at least one case of a critical industry or manufacturing facility requiring adequate rural air service for just in time deliveries, emergencies, or even day to day management travel.

Workforce - Employment

Respondents indicated two dimensions to employment related to air logistics. First, air cargo jobs are good jobs and so far, both metro and rural areas have been able to supply the needed workforce. These cargo air facilities can be a significant economic driver. Second, the workforce dimensions are rapidly changed with the pandemic. With a potential lack of employees in warehousing and trucking, new logistics models may emerge.

Opportunities:

Technology

From urban air mobility, to drone delivery and pilotless flights, these technologies are expected to change the system. The majority of respondents mentioned the changing technologies as both opportunities and a concern. These technologies can increase safety and efficiencies and reduce the environmental footprint of air cargo. But the pace of adoption and the other impacts must be considered. All modes face the difficult question on automation – what happens when it does not work correctly? Additionally, more air traffic, especially in situations of home delivery create noise, privacy issues, and safety concerns.

Advance Integration of Air Cargo into Freight Planning and Operations

Freight aviation has not been a significant part of most state freight plans. And required state aviation plans only include a mention of air cargo. Both documents generally include tonnages and value of the shipment but rarely much more. Greater integration and increased awareness of air cargo in agency freight planning and operations can increase the freight brand power of an agency and could result in benefits to both the industry and the agency.

Similarly, when asked about including freight aviation representatives on the FAC, several respondents mentioned it is hard to identify the correct person to invite. Additionally, their tenure is often short lived due to job priorities, and possibly the meetings are less attractive due to fewer air cargo discussions. Special sessions of the FAC meeting could be held annually with attendance and presentations from key freight aviation stakeholders to educate and network with the agency's freight network.

Funding

Also falling in several categories, funding is considered both an opportunity, a concern, and an area for improvement. Like most of the transportation system, there has been inadequate funding to maintain or develop the system. All respondents cited the need for additional funding for unending project needs. The aviation planning and project experience is much like general transportation planning in that there are more projects than there are funds. One possible inroad to greater participation by freight aviation in the overall agency agenda was cited by a mid-size freight generator in Missouri. They had used the agencies new competitive freight program to accelerate development at their facility. With freight programs implemented across the region, greater integration of freight aviation is more likely.

Developing a Technology or Service Hub

Similar to developments in CAV, several states indicated that developing technology and automation are an immediate and long-term economic development tool. By being first in accommodating these developing industries and modes, states can benefit from business clustering in support of the facilities or service. Advanced aviation testing and drone and air mobility development facilities were mentioned as two possibilities.

Concerns and Areas for improvement:

Funding

Funding ranked the number one response as a concern and area for improvement for continued safe and efficient aviation infrastructure. All major infrastructure projects face these same challenges. Increasing awareness of the role air cargo plays in freight movement and economic development can result in additional funding support. Again, providing for an air cargo specific

session in the state FAC meeting, and integrating planning and operations across the freight modes will provide for a greater awareness and support for air cargo.

Technology

Drones, pilotless planes, data, and communication technologies are rapidly evolving. As with CAV, the questions remain whether the system is safe, and if there are jobs lost or displaced with the new technology? And when will it happen? With this level of potential change in the air cargo industry it is a critical time to better collaborate with air cargo stakeholders to understand the composition and pace of the change.

Workforce

The number of available employees, the training needs for advanced technologies, and the importance of air cargo for rapid and critical deliveries are issues that will require planning and multi-industry coordination. Increasing industry participation in agency freight planning and operations will increase awareness of the types and pace of the anticipated changes. Without this increased integration and communication, the agencies will not have the stakeholder input to support the developments.

Unexpected Impacts

Air Traffic congestion, noise and privacy impacts with drone home delivery are just a few of the potential areas that should be considered in the planning process prior to implementation. Greater integration and participation of air cargo planning and operations in agency freight systems planning can help identify these potential impacts as well as solutions to avoid or mitigate the impacts.

Knowledge and Awareness of the System

Given the logistics and decision making in air cargo are private sector activities, agency planners are left speculating on the intentions, goals and planning within the sector. Additionally, the cargo sector has undergone tremendous changes due to COVID restrictions and even larger changes are anticipated with new technology applications. Respondents suggested an integrated industry and agency effort to assess the current system and trends, and then collaboratively plan the adoption of new technologies and logistics patterns.

8. CONCLUSIONS

Summary of Findings

The 10-state MAASTO region is home to roughly 69.7 million people (2020 census). The location of the MAASTO region in the Midwestern U.S. is strategic for all types of freight transportation, including air cargo transportation. Air freight has a primary benefit in the speed of delivery, benefiting transportation of both time-sensitive, and value-sensitive cargo. Commodities most suited to air transportation are typically high-value and often low-weight.

The scope of this report included all airports in the 10-state MAASTO region that are identified by FAA's NPIAS. Eight hundred fifteen airports in the region are included in the NPIAS, with 673 categorized as general aviation airports, 86 as commercial, and 56 as reliever airports. Data from the U.S. DOT Bureau of Transportation Statistics in the form of the T-100 database, and from FHWA's Freight Analysis Framework (FAF) served as the major sources of data for this study.

According to the T-100 database, a total of 10,980,294 tons of air cargo were either enplaned or landed at airports in the MAASTO region in 2021. Nearly half of this total activity (46.51 percent), 5,106,992 tons were handled in Kentucky. A little over one quarter (26.55 percent), 2,914,586 tons were handled in Illinois. Indiana saw 1,345,647 tons of air cargo activity. These three states together, home to major airport hubs for express carriers, were responsible for handling 85.3 percent of the region's total air cargo activity. The four largest airports in the region were Louisville, KY, Chicago, IL, Cincinnati, OH, and Indianapolis, IN. We also see that UPS and FedEx are the largest carriers in the region for air cargo.

Analysis of the FAF database for air cargo activity by value shows that air cargo movement was responsible for \$219 billion out of the total of \$6.1 trillion of total freight movement valuation in the region in 2020. Illinois and Kentucky were the states responsible for the highest air cargo movement valuation. The top five commodities transported via air to/from the MAASTO region in 2020 were Electronics, 42.1 percent share by value), Precision Instruments (14.5 percent), Pharmaceuticals (11.0 percent), Machinery (10.5 percent), and Transport Equipment (5.0 percent). Air cargo between the MAASTO region and countries in Europe and Eastern Asia, as well as California, accounted for a majority of air freight activity by value in 2020.

Air cargo is critical to the MAASTO region. Just in time service to rural facilities for advanced manufacturing, or UPS services through Louisville; freight aviation provides a service no other mode can match. Integrating freight aviation planning and the network into current agency freight planning and operations can be assumed to provide benefits to the agency as well as the private sector.

Recommendations to advance this integration include: creating a FAC session focusing on air cargo and the networks involved, creating greater awareness in the agency and the public regarding the importance of freight aviation, marketing freight funding programs to air cargo facilities, providing for more integration between freight and aviation planning, and completing a study of the regional system capacities and planning to better coordinate planning and operations for the expected changes in technology and logistics.

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APPENDIX A – NPIAS AIRPORTS

NPIAS Classification

NPIAS airports are grouped by statute into Primary and Non-Primary categories. Primary airports are defined in the FAA’s authorizing statute as public airports receiving scheduled air carrier service with 10,000 or more enplaned passengers per year. Primary airports are further grouped into four categories defined in statute: large hub, medium hub, small hub, and non-hub.

Nonprimary airports primarily support general aviation aircraft. The nonprimary category includes nonprimary commercial service airports (public airports receiving scheduled passenger service and between 2,500 and 9,999 enplaned passengers per year), general aviation airports, and reliever airports. These airports are further grouped into five categories: national, regional, local, basic, and unclassified.

MAASTO Region Overview

Table A- 1: Overview of number and categorization of NPIAS airports in the MAASTO region

State	Total Airports	Private	Public	Total NPIAS	Primary				Total	
					L	M	S	N	Primary	Non-Prim
IA	278	157	121	79	0	0	2	3	5	74
IL	698	593	105	83	2	0	0	9	11	72
IN	516	398	118	65	0	1	0	3	4	61
KS	371	233	138	80	0	0	1	4	5	75
KY	263	205	58	55	0	1	2	2	5	50
MI	478	251	227	95	1	0	1	13	15	80
MN	469	320	149	97	1	0	0	7	8	89
MO	508	383	125	75	0	2	1	2	5	70
OH	659	501	158	99	0	2	1	3	6	93
WI	540	414	126	87	0	1	1	6	8	79

Illinois

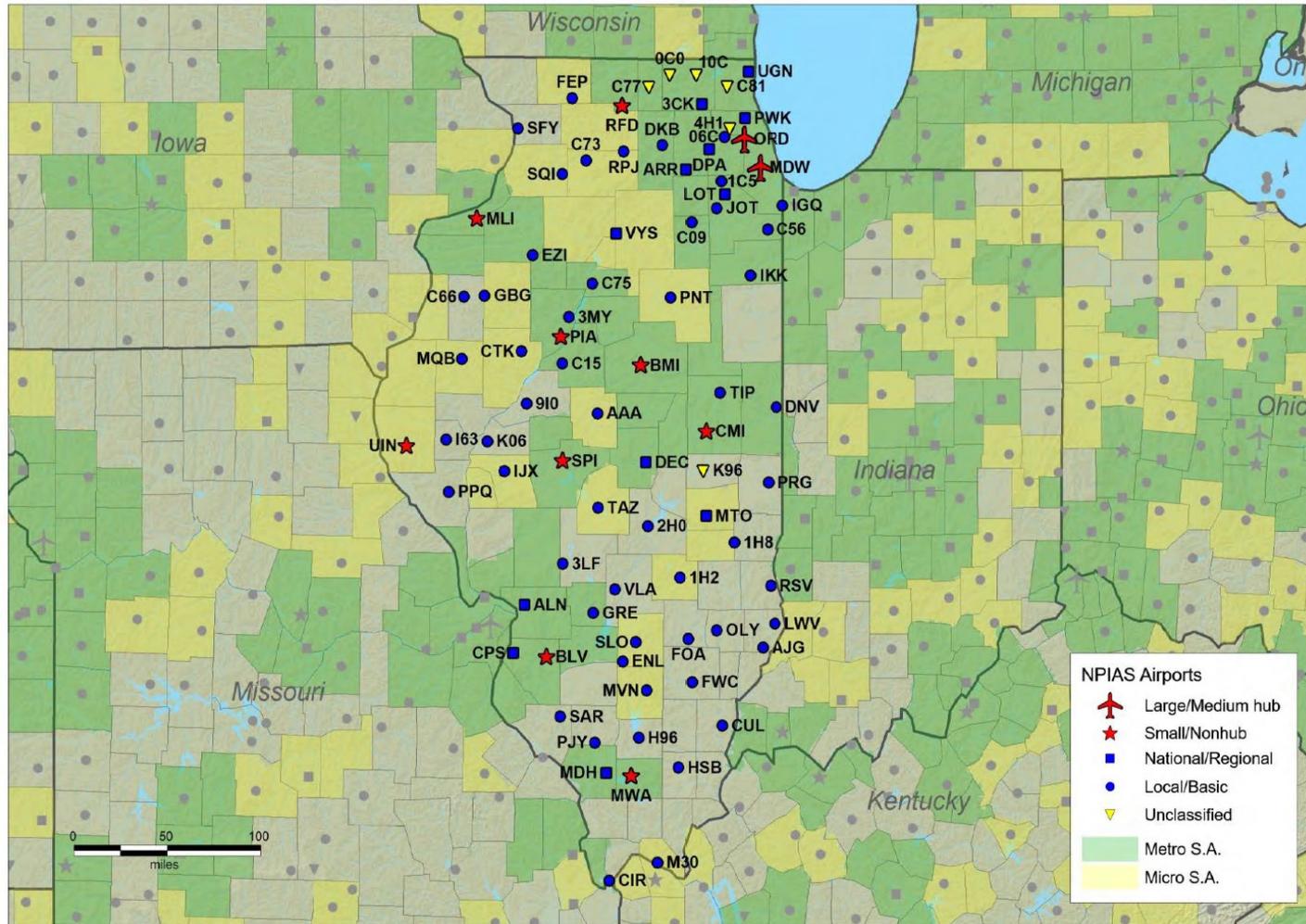


Figure A- 1: NPIAS Airports in Illinois

Indiana

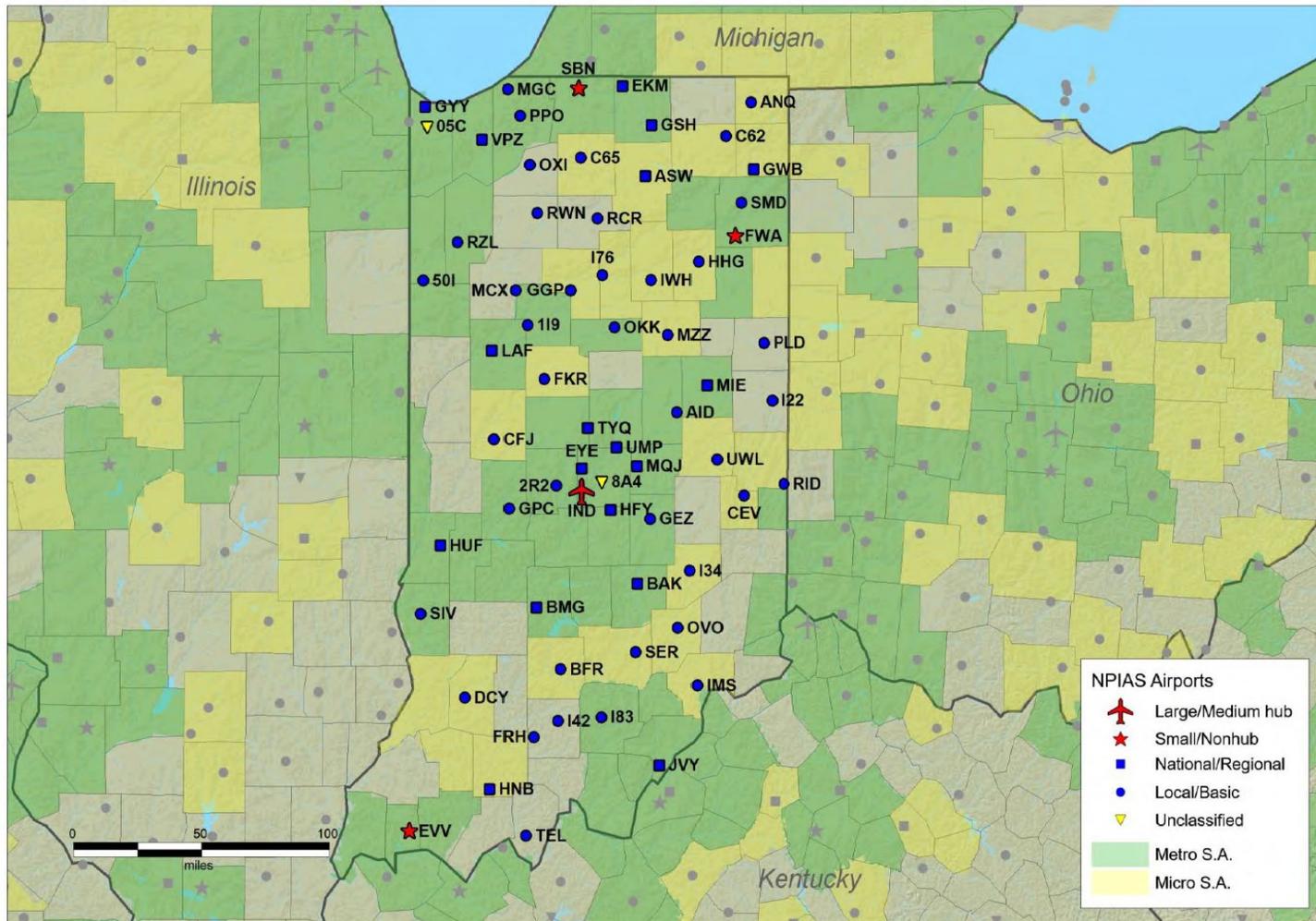


Figure A- 2: NPIAS Airports in Indiana

Iowa

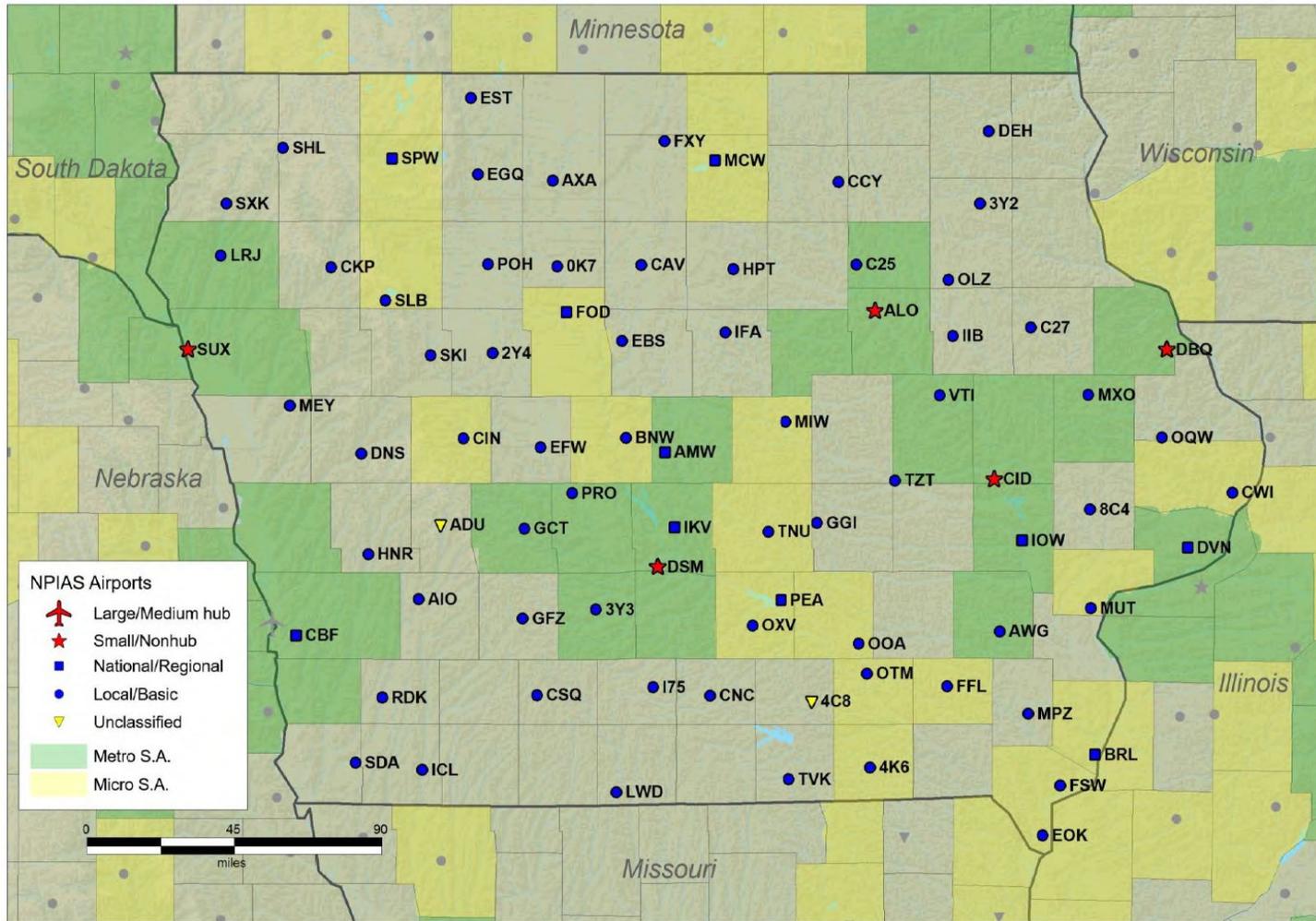


Figure A- 3: NPIAS Airports in Iowa

Kansas

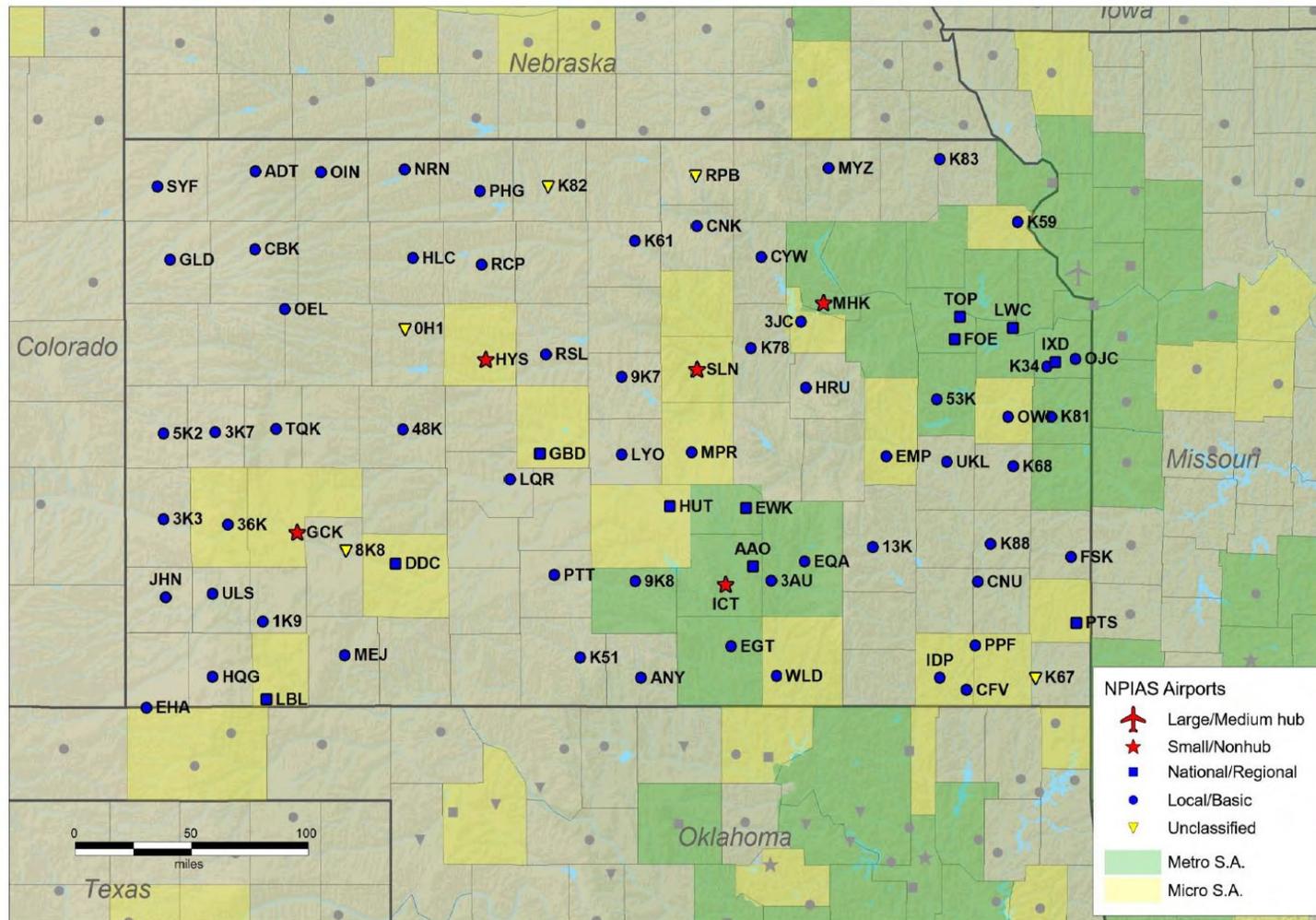


Figure A- 4: NPIAS Airports in Kansas

Michigan

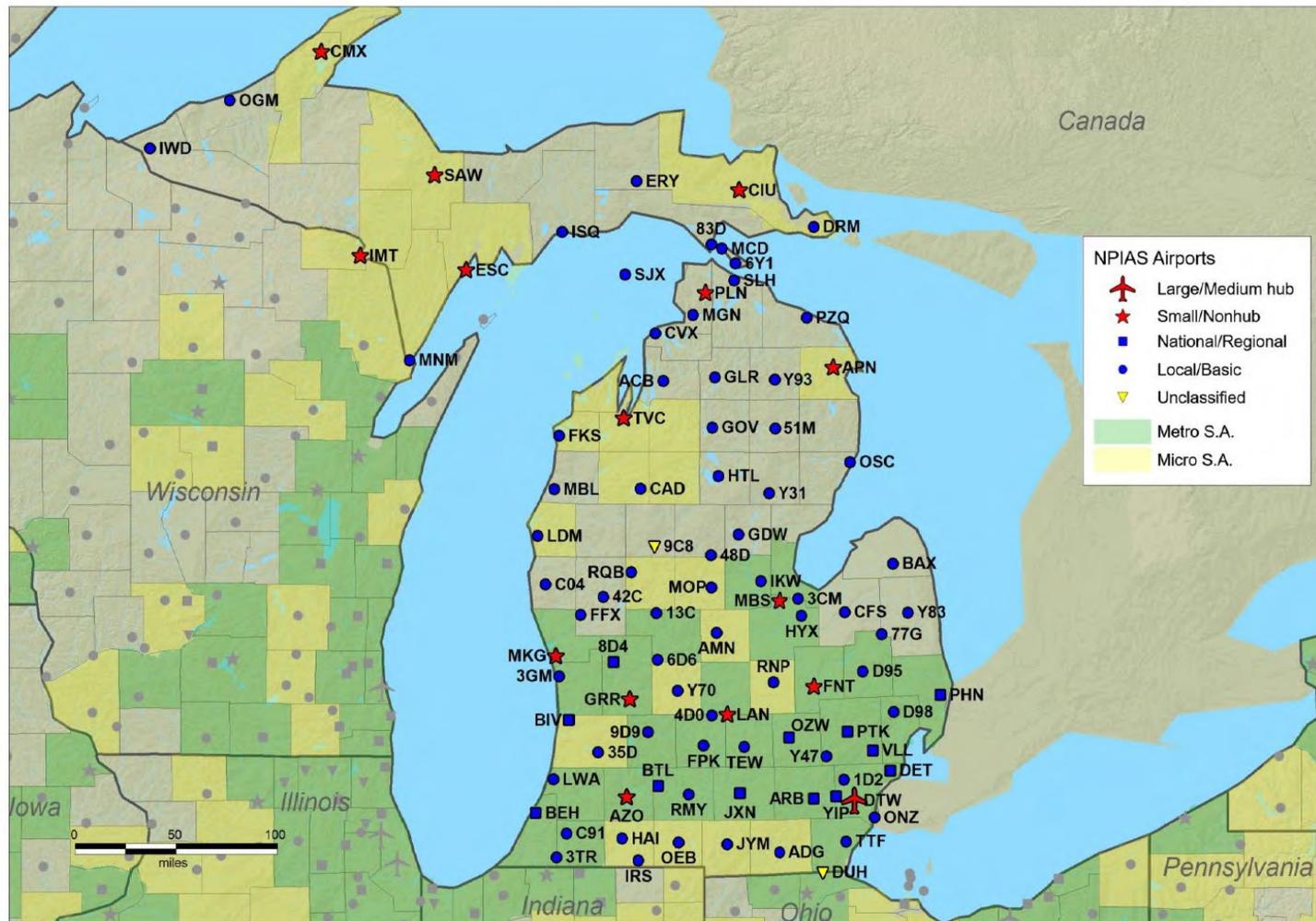


Figure A- 6: NPIAS Airports in Michigan

Minnesota

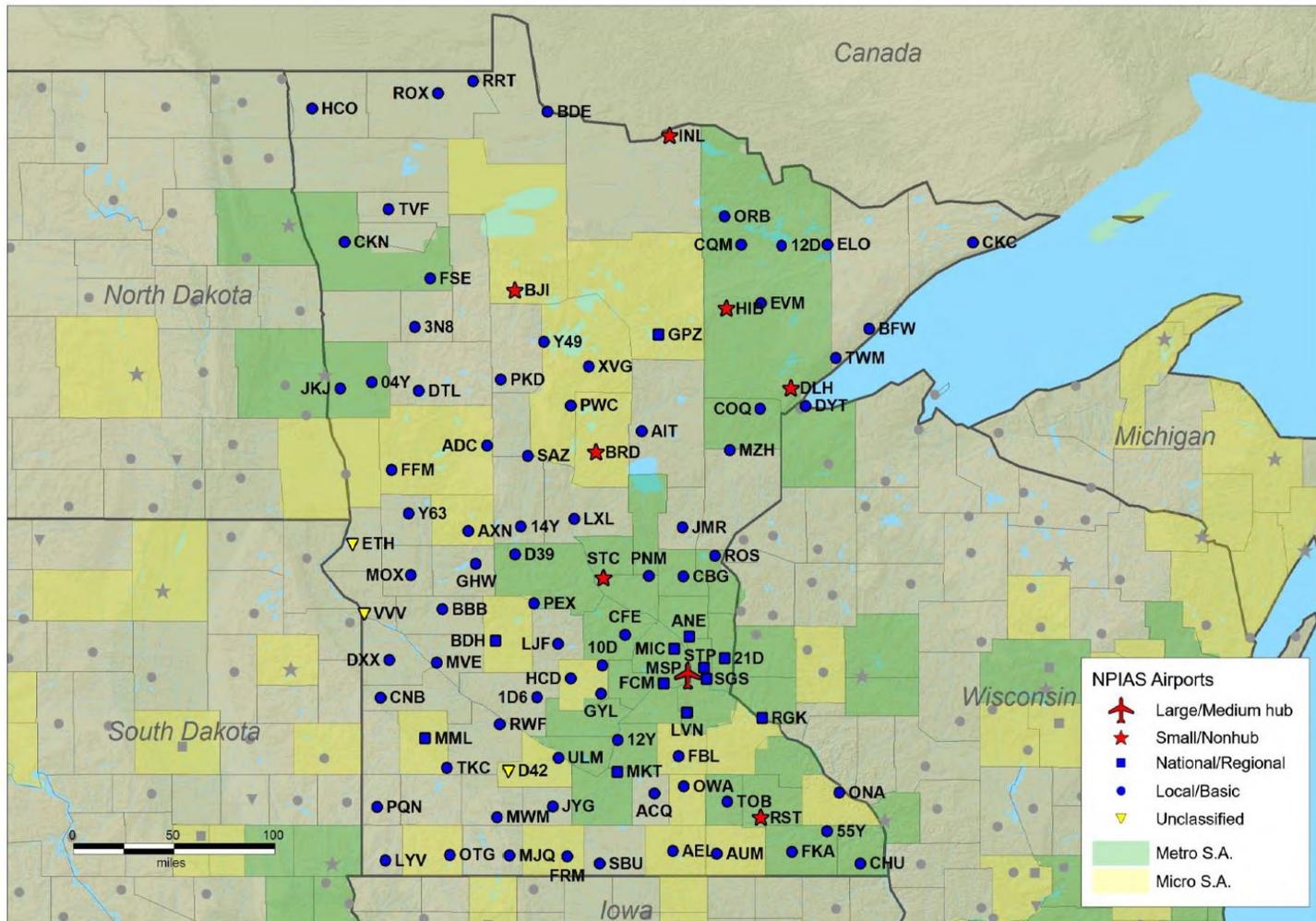


Figure A- 7: NPIAS Airports in Minnesota

Missouri

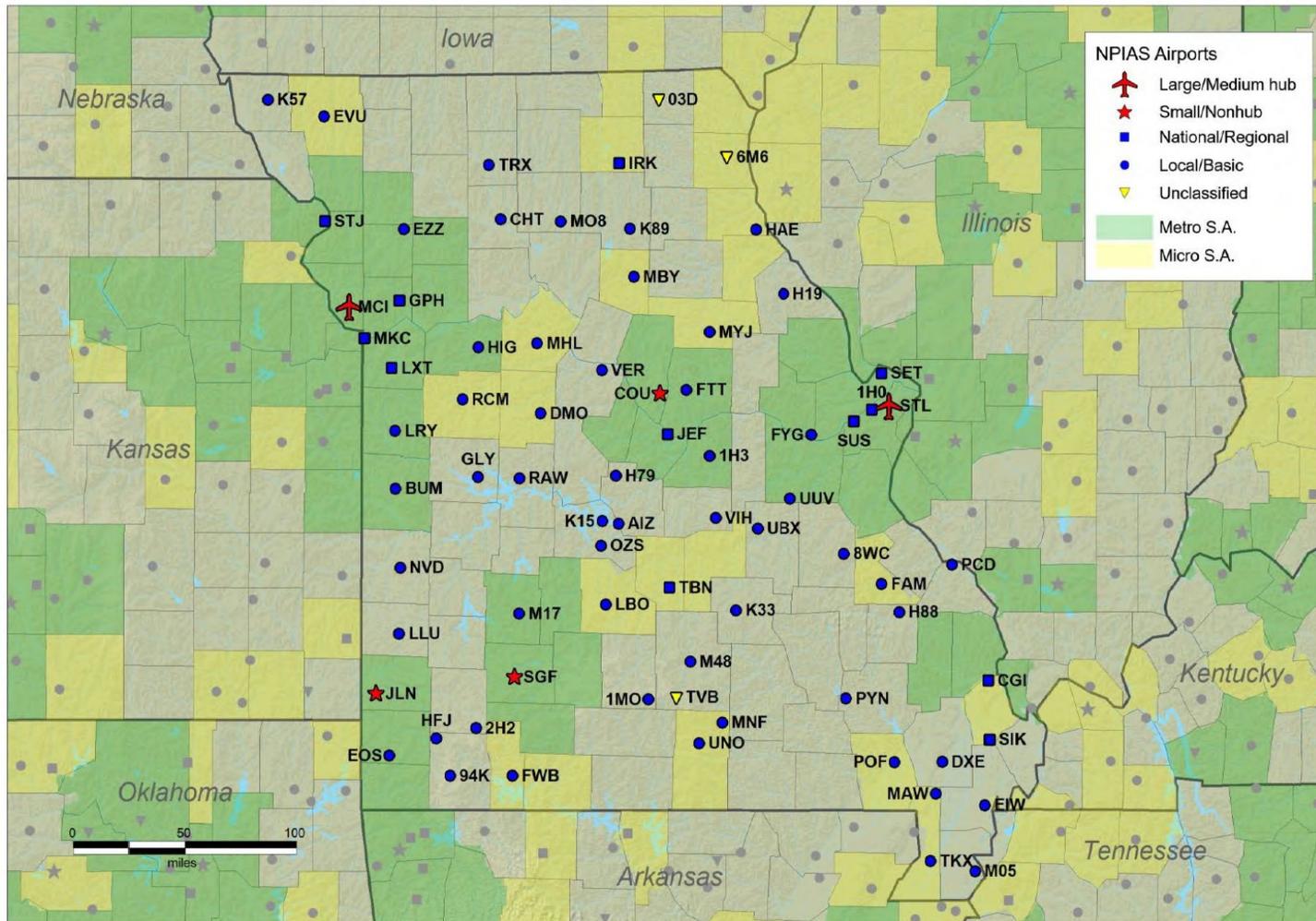


Figure A- 8: NPIAS Airports in Missouri

Wisconsin

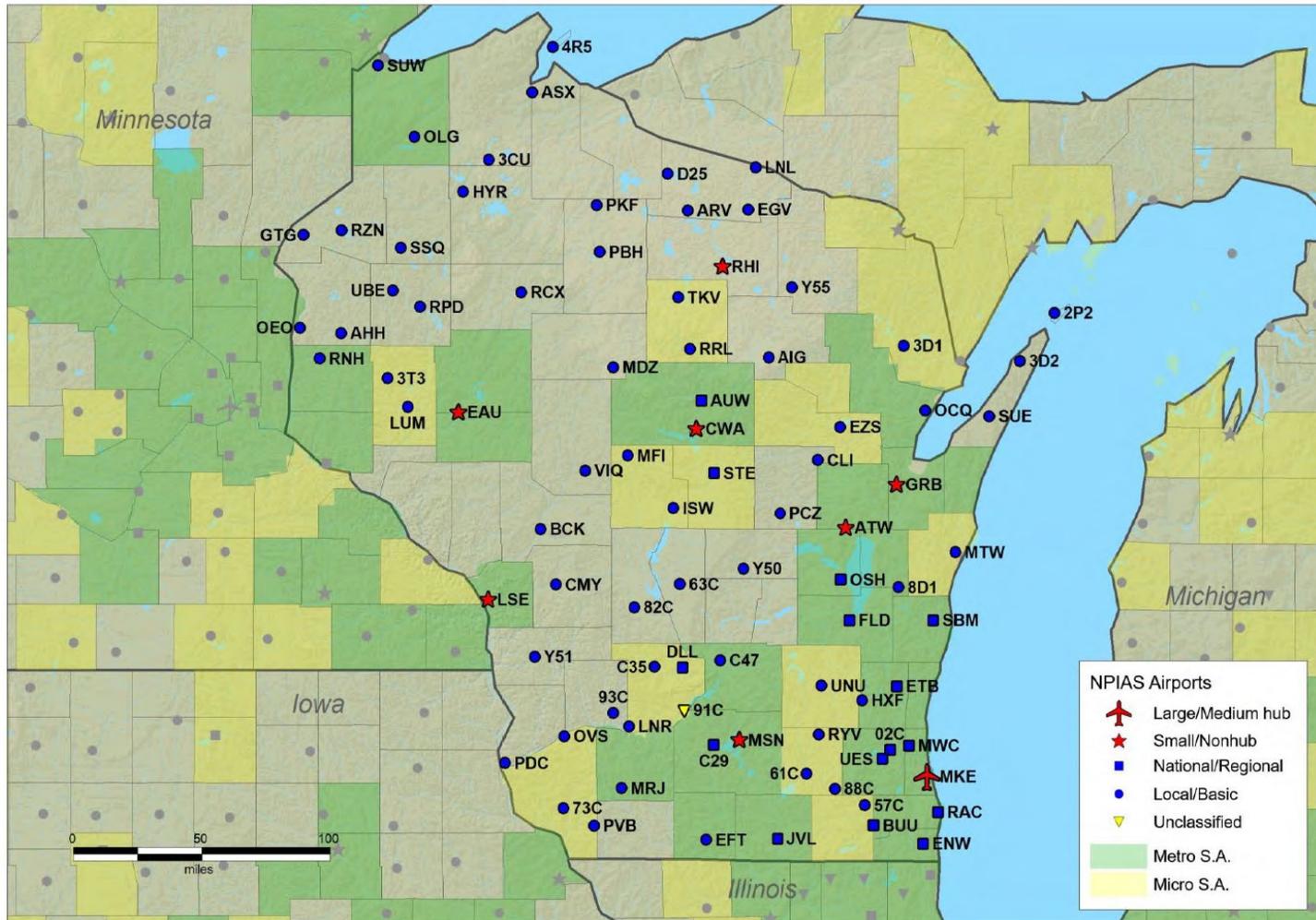


Figure A- 10: NPIAS Airports in Wisconsin



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