Air Cargo in Hawaii's Economy

Developments in Hawaii's Air Cargo Industry
1990 – 2016

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I. Introduction

The air cargo industry is an essential component of Hawaii's economy. High value products as well as perishable time-sensitive fresh agricultural products and seafood are transported to and from the mainland and global destinations.

The global economy has become more speed-driven and globally inter-connected (Kasarda et al., 2005). With this, trends have emerged that have favored air cargo, including just-in-time inventory management, the exponential growth of e-commerce, and increased demand for perishable products. The growth surge of air cargo started in 1997, with the Air Cargo Deregulation Act (US Congress, 1980). The deregulation spurred innovation and competition among air carriers, propelling the rapid expansion of air cargo both domestically and globally. US deregulation was followed by deregulation in Europe (Sharpenseel, 2001) then Asia (Sharpenseel, 2010).

In addition to deregulation, developments in aerospace technology have allowed planes to carry more cargo longer distances. Increased power and efficiency in design and engines are crucial in increasing a plane's cargo capacity and diversifying destinations even further (Crabtree, et al., 2016). For example, the Australian carrier, Qantas airlines, recently announced the first non-stop long haul service from Sydney to London – the world's longest non-stop route at 20 hours and 20 minutes (Qantas, 2017). In looking towards the future, the development of these ultra-long-haul flights could open up non-stop service from Hawaii to Europe and other remote destinations, which in turn, could create market expansion opportunities for Hawaii's perishable and time-sensitive products.

The niche for air cargo is in the value of goods shipped, rather than the weight and/or volume of goods shipped. As measured by weight, the maritime cargo industry comprises a vast majority of the annual cargo tonnage. According to Boeing, in 2015, the global maritime industry carried an estimated total of 10.8 billion tons of freight compared to 52.2 million tons of freight for the air cargo industry. More than 84 percent of the weight of global maritime trade is in raw materials and other bulk items. Most of these commodities, such as oil, metal ores, and grains, are low value, non-time-sensitive, and shipped by sea in specialized tankers or bulk carriers.

Although less than 1 percent of global tonnage is shipped by air, this 1 percent comprises approximately 35 percent of the total value of global freight shipped annually (Crabtree, et al., 2016). Generally, goods that are shipped by air share one or more of the following characteristics: high value, light weight, time sensitive, and/or perishable (Lee, 2007). An example is consumer electronics such as computers, tablets, and cellular phones, which comprise a large portion of global air freight.

For Hawaii, in 2015, the top commodities by value air freighted to the state (deplaned) included the following: electronics, precision instruments, miscellaneous manufactured products, machinery, motorized vehicles, transport equipment, textiles, pharmaceuticals, and meat/seafood.

On the other hand, among the top commodities by value air freighted out of the state (enplaned) were the following: agricultural products, chemical products, machinery, miscellaneous manufactured products, transport equipment, pharmaceuticals, foodstuffs, and precision instruments.

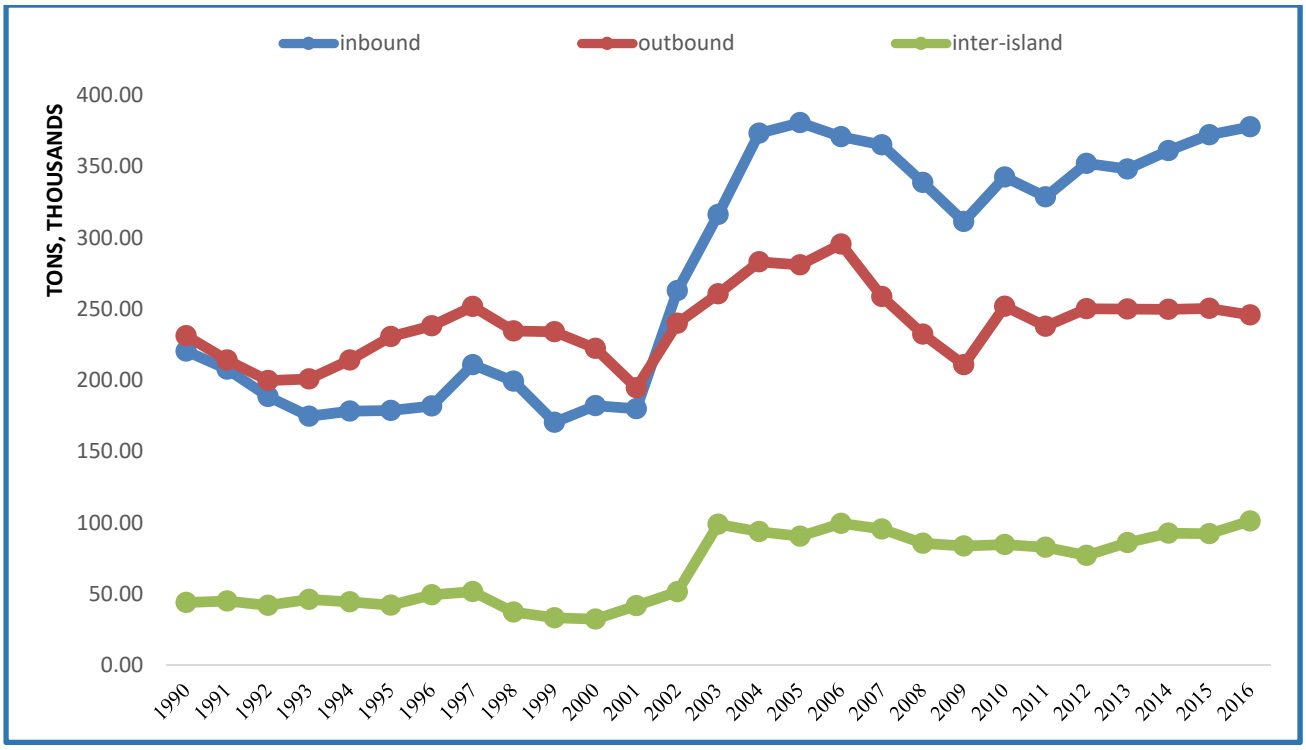
There has been a shift in the trend of Hawaii's air cargo industry from a majority of the cargo being shipped outbound to a majority of the cargo being shipped inbound; in other words, a shift from export to import. This shift really took off in 2002, when air cargo destined for Hawaii from out-of-state locations increased by 55 percent over the previous year. This was not a one-time change, but a sustained new trend, with inbound cargo overtaking outbound cargo.

One of the primary drivers for the large increase in inbound air-cargo was e-commerce. Not just e-commerce, per se, but the innovation of internet-based retailers to bundle products with free or deeply discounted shipping. For example, according to Amazon, starting in January 2002, the company provided free shipping with orders over a certain threshold amount. While there is no Hawaii-specific data available, this allowed Hawaii residents to purchase and receive products fast and free of shipping charge (Amazon, 2002). Given the continued growth of e-commerce, it is likely that Hawaii's inbound air cargo volumes will remain high.

II. Hawaii Air Cargo Trends

A. Total Flow Volumes. Prior to the explosive growth of internet retailing in the early 2000's, outbound air cargo tonnage exceeded inbound air cargo tonnage (Figure 1). However, as internet retailing took off in the early 2000's, this trend reversed as inbound air cargo volumes far surpassed outbound air cargo and the gap continued to increase.

Figure 1: Air Cargo and Mail: Total Annual Tonnage in Hawaii – Inbound, Outbound, and Inter-Island, 1990 - 2016



Source: DBEDT calculations based on data from the United States Department of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017)

From 1990 to 2016, total inbound air cargo and mail increased by 2.72 percent per year on average. The increase in inter-island air cargo and mail shipments was even more pronounced, increasing by about 4.86 percent per year on average. In contrast, during the same period, outbound tonnage increased by a mere 0.59 percent per year on average

There was an even sharper contrast when the 1990-2000 period (1990s) was compared to the 2010-2016 period (2010s). Comparing the 1990s to the 2010s, there was an 86 percent increase for inbound air cargo, while outbound cargo and mail increased by an average of just under 11 percent. Air cargo and mail on inter-island flights more than doubled in the 2010s compared to the 1990s, increasing by about 102 percent (Table 1).

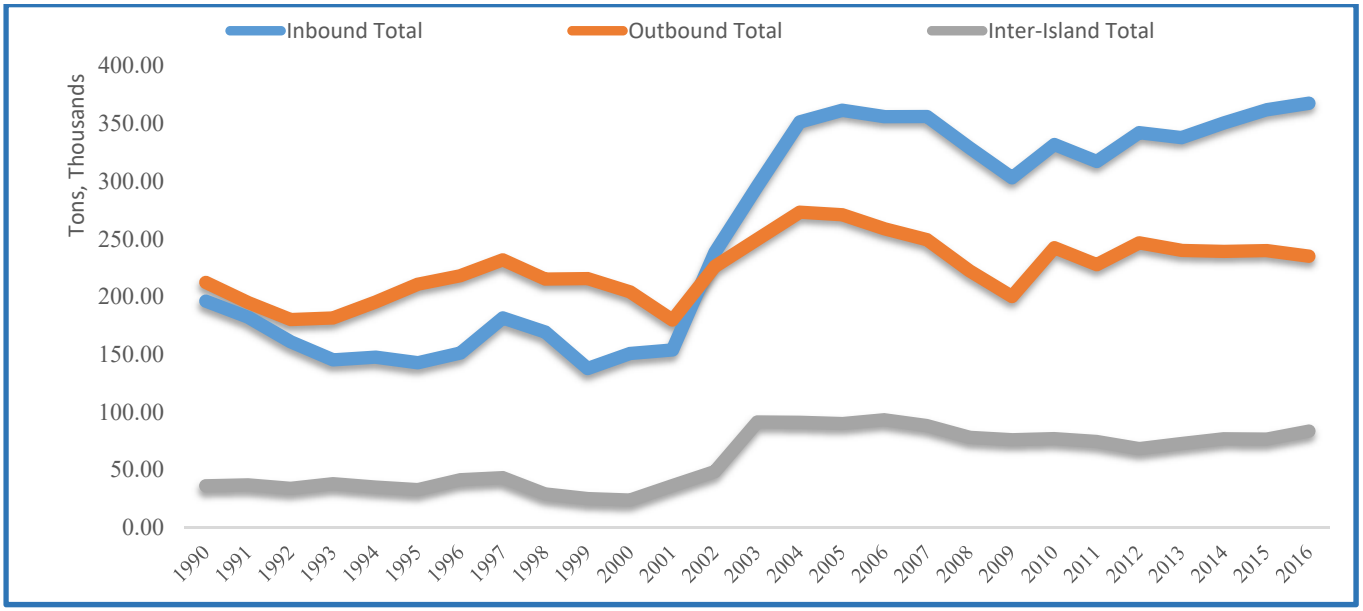
Table 1: Total Air Cargo and Mail Flows in Hawaii: 1990 – 2016

		Inbound		Outbound		Inter-Island	
Period average: 1990 - 2016		276,684.18	2.72%	238,648.22	0.59%	67,734.14	4.86%
Average: 2000 - 2016		327,272.22	5.45%	246,658.88	0.74%	81,881.44	8.61%
Last 10-Year Average: 2006 - 2016		351,607.23	0.07%	246,463.80	-0.88%	89,293.28	1.27%
Last 5-Year Average: 2012 – 2016		362,385.53	2.86%	250,496.22	0.72%	89,966.94	4.34%
Average in the:	1990s	190,684.51		225,030.10		43,683.73	
	2000s	308,248.37	61.65%	245,091.01	8.91%	77,454.02	77.31%
	2010s	354,449.16	14.99%	248,898.69	1.55%	88,206.34	13.88%
Difference in Average Annual Air Cargo Volumes in 2010s vs 1990s		**+163,764.64**	**+85.88%**	**+23,868.59**	**+10.61%**	**+44,522.62**	**+101.92%**

Source: DBEDT calculations based on data from the United States Department of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017)

When splitting air cargo and air mail, there is an almost inverse relationship between air cargo and air mail: as air cargo tonnage increased, air mail decreased. Figures 2 and 3 show this difference and their divergent paths.

Figure 2: Air Cargo in Hawaii: Total Tonnage – Inbound, Outbound, and Inter-Island, 1990 - 2016

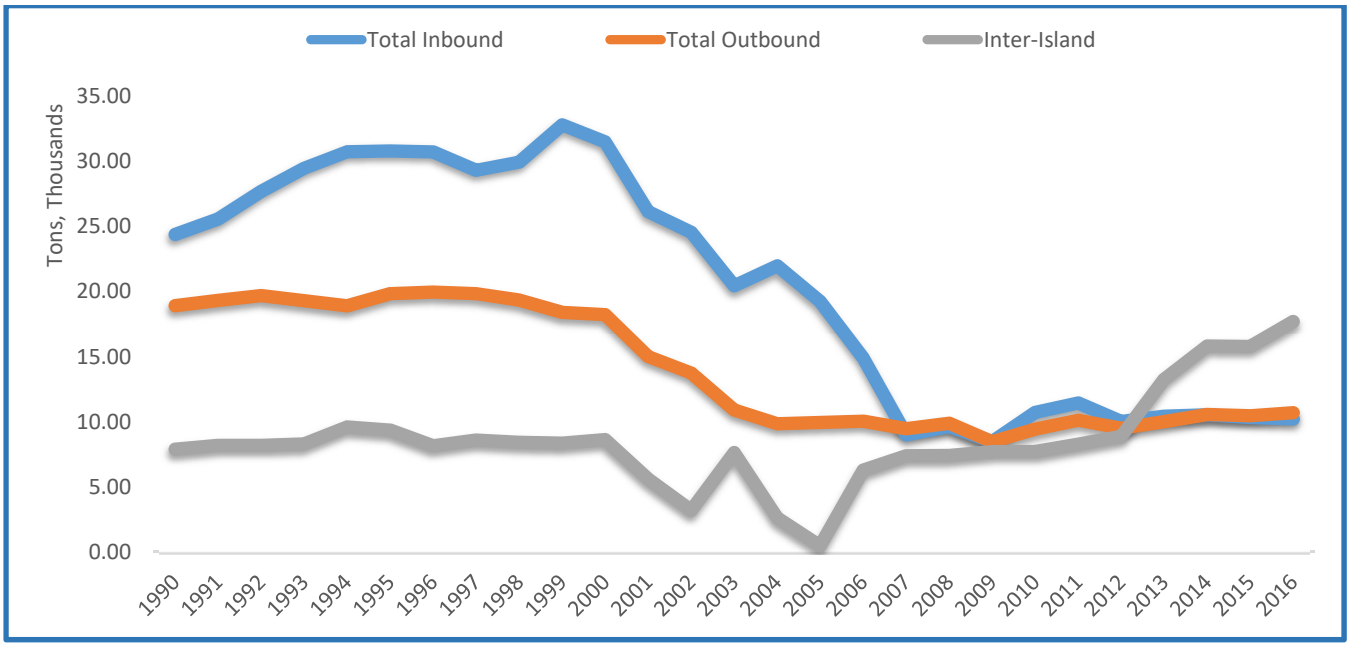


Source: DBEDT calculations based on data from the United States Department of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017)

With large decreases in volumes of air mail from 1990s into 2000s, there is a noticeable shift to cargo. The only category where air mail volumes increased, both compared to the 1990s and in

recent years, was for inter-island air mail shipments. Even though shipments classified as air mail fell to very low volumes in 2004 and 2005, they have recovered, and increased to levels well above those for both inbound and outbound Hawaii air mail. However, inbound and outbound Hawaii air mail shipments have both fallen sharply, stabilizing in recent years to around 10,000 tons a year on average.

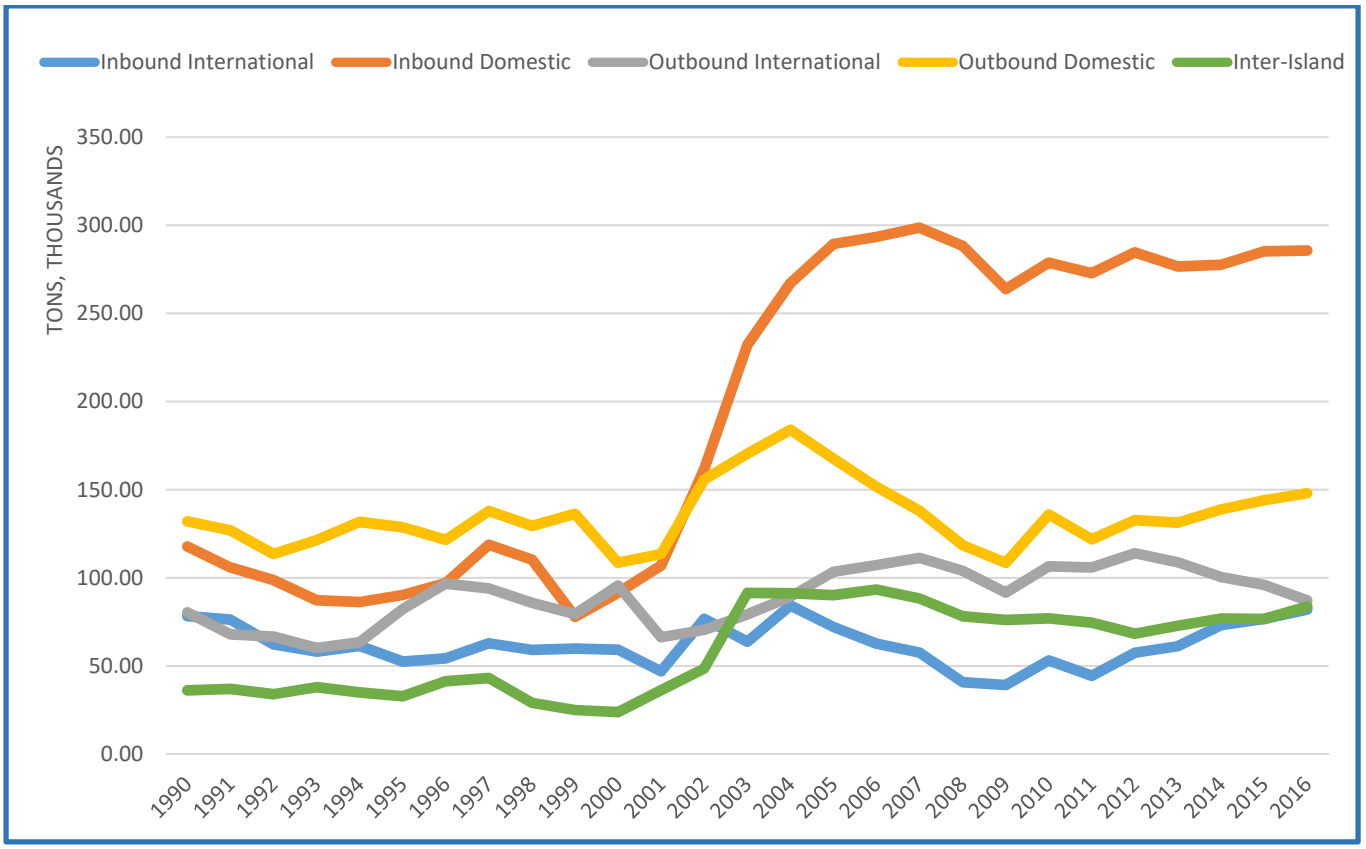
Figure 3: Air Mail in Hawaii: Total Tonnage – Inbound, Outbound, Inter-Island, 1990 – 2016



Source: DBEDT calculations based on data from the United States Department of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017)

B. Domestic and International Air Cargo. Separating Hawaii air cargo flows further into ***domestic and international origin and destination***, the largest changes take place in the early 2000s, with domestic inbound increasing the most. As Figure 4 shows, Hawaii's inbound air cargo from international destinations increased on average at about 2 percent per year, and air cargo from Hawaii to international destinations increased by about 1 percent per year. However, domestic inbound air cargo, increased by just under 9 percent per year since 2000. This is a sharp contrast to outbound cargo for mainland destinations, which increased at an average of 1.4 percent per year during the same period. However, the volumes for domestic outbound air cargo are larger than those for international inbound and outbound.

Figure 4: Hawaii Air Cargo Total Volume – Inbound, Outbound, and Inter-Island: by foreign and domestic origin and destination – 1990 - 2016

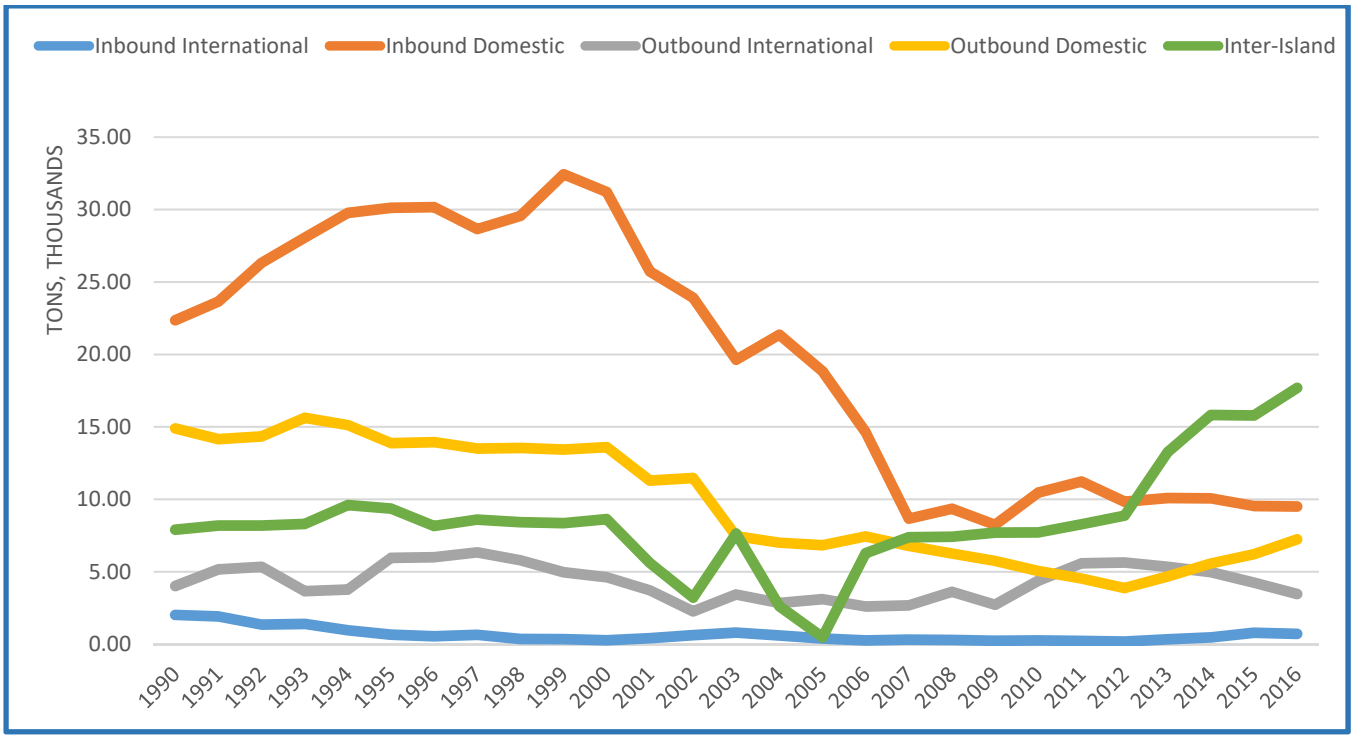


Source: DBEDT calculations based on data from the United States Department of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017)

A detailed analysis of Hawaii's air mail volumes (separated into domestic and international flows) shows a fairly steady contraction, with the exception of inter-island air mail volumes (Figure 5).

It is also notable that international air mail bound for Hawaii dropped from just over 2,000 tons in 1990 to about 177 tons in 2012; reaching a low level and then recovering somewhat in the past five years.

Figure 5: Hawaii Air Mail Total Volume – Inbound, Outbound, Inter-Island: by foreign and domestic origin and destination, 1990 - 2016

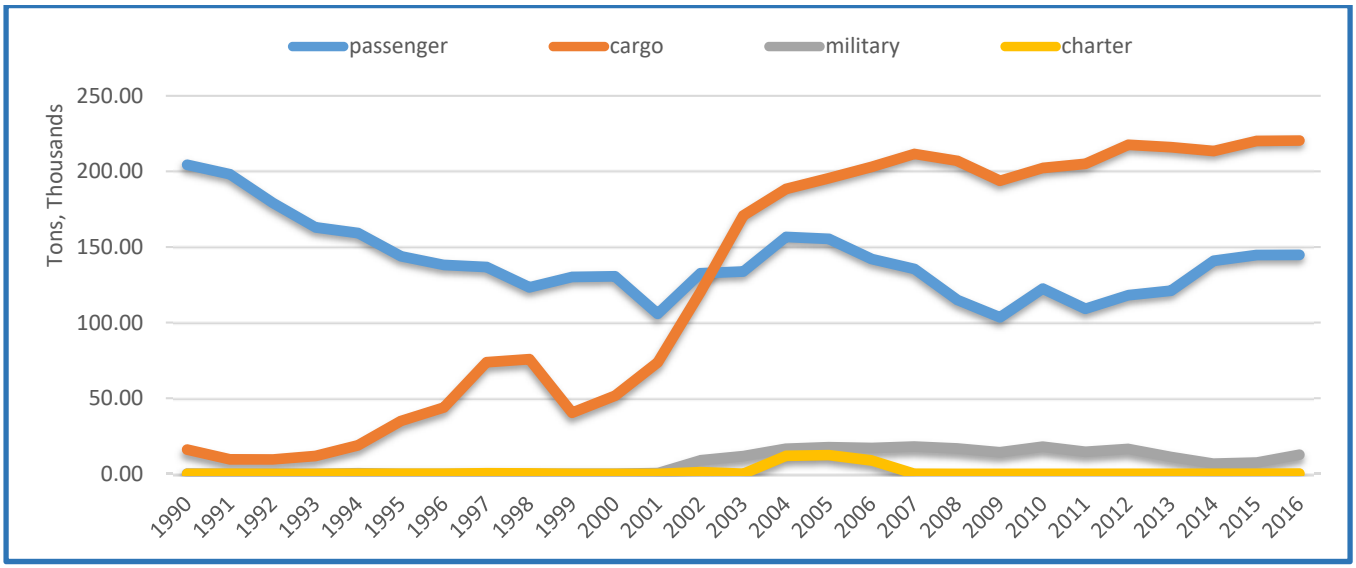


Source: DBEDT calculations based on data from the United States Department of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017)

C. Air Cargo by Type of Carrier. There is an increase in specialization for air cargo shipping. This is a shift away from the 1990s, when a majority of air cargo was shipped in the belly of passenger planes. Today, more freight is being shipped by cargo-only carriers such as Atlas Air, UPS, FedEx, Kalitta Air, Asia Pacific, ABX Air, along with Aloha Air Cargo, and Rhoades Aviation (Transair and Transair Express), with the latter two being more active in the inter-island air cargo transportation. In addition to these carriers, there are other cargo-only carriers, which specialize in either scheduled cargo delivery or chartered cargo (sometimes both).

Growing volumes of air cargo, especially inbound from the US mainland, explain much of the shift to cargo-only carriers. In addition to larger volumes, specific requirements, such as refrigeration, space for larger items, and other requirements, which regular civilian passenger aircrafts may lack, contributed to the growth in cargo-only carriers.

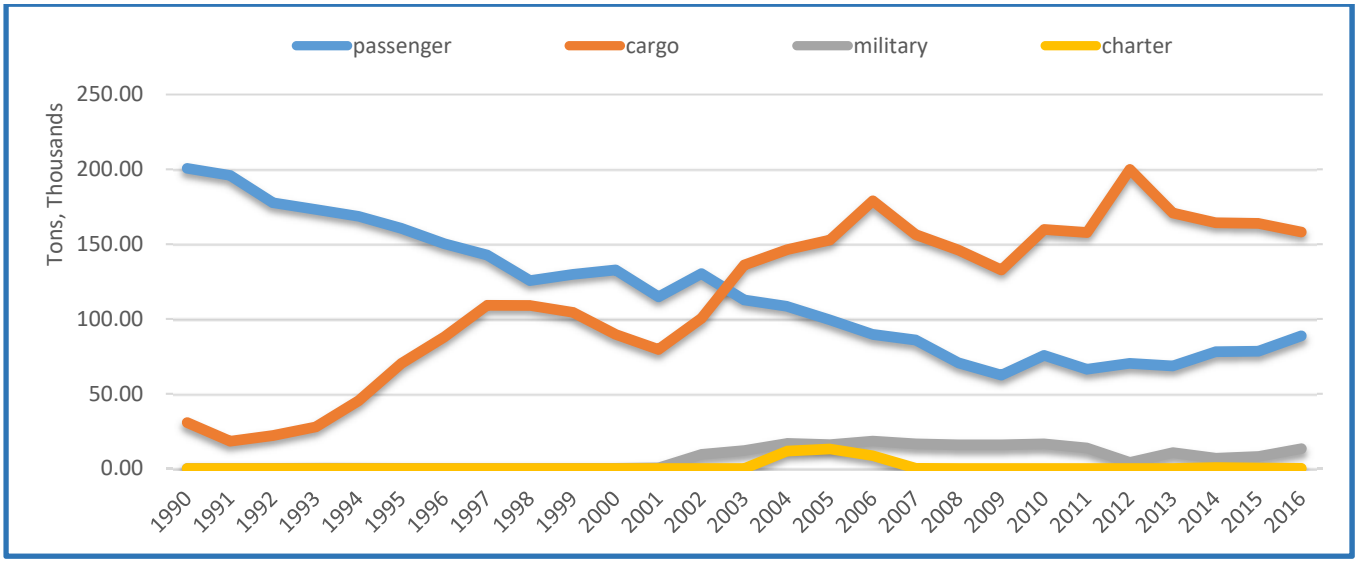
Figure 6: Inbound (Deplaned) Total Air Cargo and Mail in Hawaii by Type of Air Carrier, 1990 - 2016



Source: DBEDT calculations based on data from the United States Department of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017)

Comparing total air cargo volumes for goods shipped to Hawaii with those leaving the Aloha state, there is also an increase in the volumes shipped by the air cargo carriers (although a more gradual one), but a larger comparative decrease in the volume of cargo transported by the passenger carriers. Figure 7 highlights these differences.

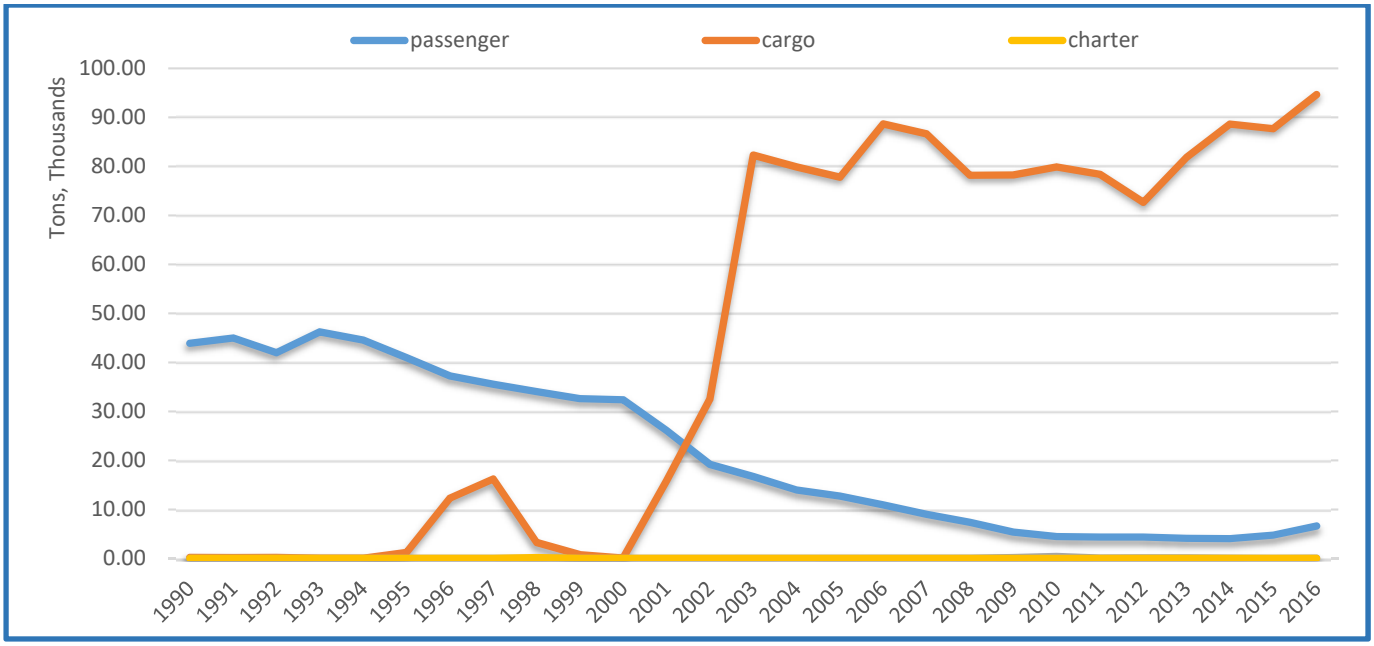
Figure 7: Outbound (Enplaned) Total Air Cargo and Mail from Hawaii by Type of Carrier, 1990 - 2016



Source: DBEDT calculations based on data from the United States Department of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017)

However, the sharpest change occurred on the inter-island flights, where a shift has occurred from carrying cargo on passenger flights (between 1990 to about 2001) to air cargo increasingly being carried by the cargo-only carriers. Figure 8 shows the growth in air cargo being transported by air freight specialty carriers. It is important to note that military does not show up in Figure 8 due to negligible inter-island volumes.

Figure 8: Inter-Island Air Cargo in Hawaii by Type of Carrier, 1990 - 2016

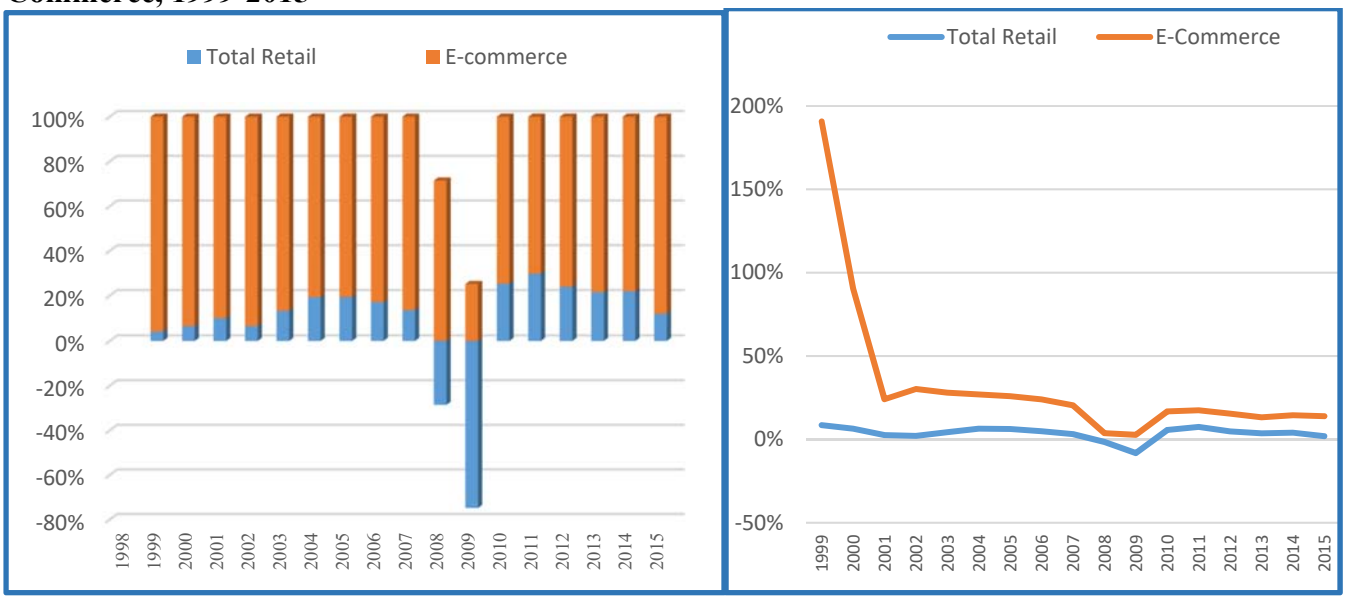


Source: DBEDT calculations based on data from the United States Department of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017)

The increase in air cargo specialty carriers (non-passenger) could partially be explained by the growth of ***e-commerce***. While there is only limited state-specific data regarding online shopping, a *Business Insider* study estimated that that Hawaii ranked third in the nation for the amount of online shopping per order at $140. Furthermore, Hawaii accounted for roughly 0.5 percent of America's total online shopping (Business Insider, 2012).

As noted earlier, E-commerce has grown exponentially in the United States since late 1990s, with the rise of online shopping giants, such as Amazon, Ebay, along with the "brick-and-mortar" retailers' own websites. For example, Amazon's sales alone grew by 858 percent in 1997, which contributed to more people at least trying online shopping (Amazon, 1998). Figure 9, based on US Census data, shows how e-commerce compares with total retail in the United States.

Figure 9: Growth in Retail Trade: Annual Percent Change In Total Retail and E-Commerce, 1999-2015



Source: US Census Bureau, 2017

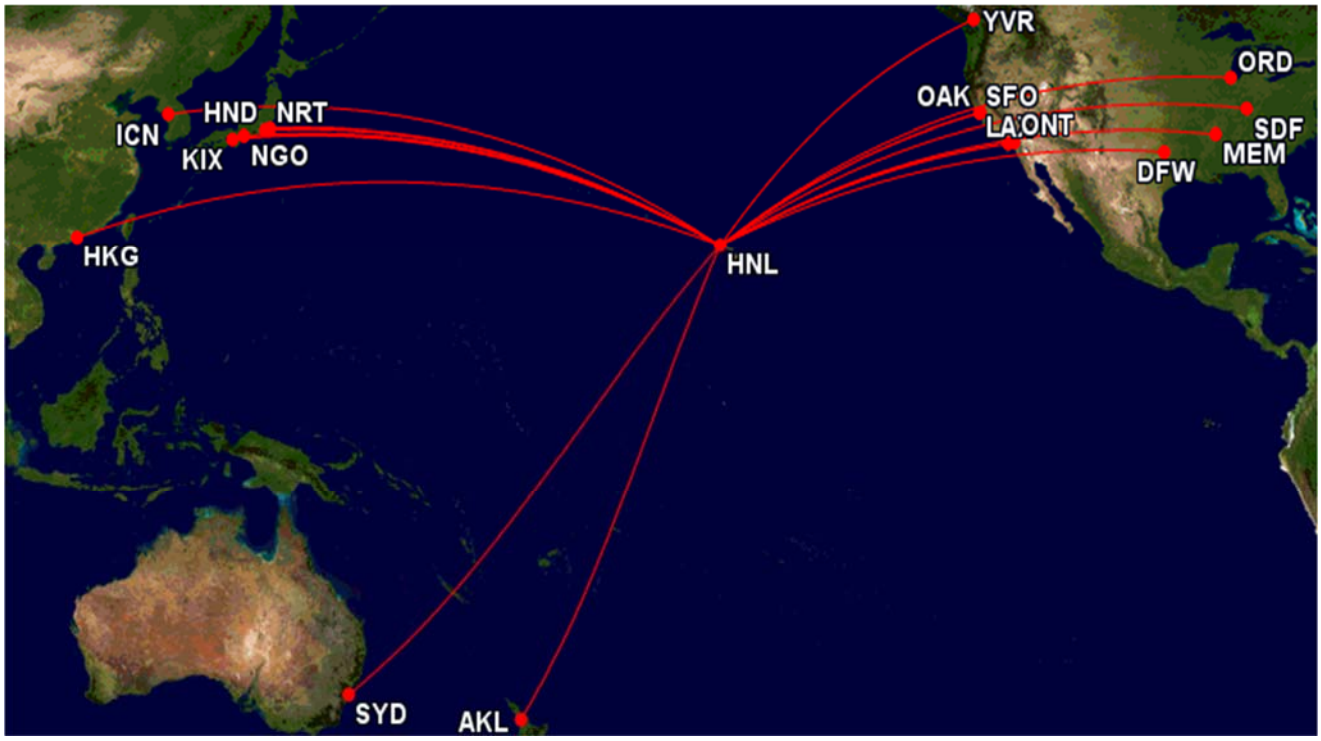
Historically, some shopping sites did not ship to Hawaii and others charged extra for shipping to Hawaii. So what propelled the tremendous growth of Hawaii's internet shopping and the correlated increase of air cargo shipments to Hawaii? A large part of the answer is the gorilla of e-commerce, Amazon.com. In 2002, the change in Hawaii's inbound air cargo from mainland airports increased 63.4 percent over the previous year. Furthermore, this was the year Amazon introduced free shipping for orders above a certain threshold. This not only increased the quantity of online shoppers, but also increased the dollar amount per order in order to meet the minimum threshold. According to Amazon's 2002 annual report, "*In January 2002, we introduced a new shipping option at www.amazon.com, offering everyday free shipping for certain orders that exceed a specified amount, and we lowered this threshold several times throughout the year...These shipping offers reduce shipping revenue as a percentage of sales and cause our gross margins on retail sales to decline. We view these shipping offers as an effective marketing tool*." (Amazon, 2002).

Another observed trend was inbound and outbound air cargo for ***military use***. Military air cargo is defined as flights carrying cargo, originating from or destined to either a Hawaii military base – such as Hickam, Barking Sands, Marine Corps Base Hawaii – Kaneohe (MCBH) – or another military base outside of Hawaii. The tonnage of military air cargo is correlated with military activity in regions such as Iraq, Afghanistan, and Asia. Military air cargo tonnage increased from 0 during the 1990s to a peak of around 18,000 tons in 2006-2008. There was no significant military-related air cargo shipped on inter-island flights[1].

1 Although this is probably somewhat understated – cargo delivered to Hawaii for military use could also be processed at the Honolulu airport, and not exclusively at the military bases. However, there is much greater likelihood of it being for the military if it is handled at the base, rather than the civilian airport.

D. Air Cargo – Top 5 Origins and Destinations (Domestic and International). The map below shows top 5 airports of origin and destinations for air cargo in Hawaii in 2016.

Figure 10: Top Airports of Origin and Destination for Hawaii Air Cargo, 2016



Source: DBEDT-created map; calculations based on data from the United States Department of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017)

It is notable that many of these airports are transshipment locations, rather than the origin of products that are shipped to Hawaii. For example, Memphis, TN and Louisville, KY are home hubs for some of the largest air cargo carriers, such as FedEx and UPS. In addition, the second-largest airport for Hawaii-bound air cargo was Ontario, CA, which is another air cargo hub. In contrast to a large number of air cargo flights, there were very few passenger flights in 2016 from the Ontario, CA airport to Hawaii.

The top international destination airport for Hawaii's air cargo was Sydney, Australia. Following Sydney in order of tonnage, were Auckland, Hong Kong, Tokyo-Narita, and Vancouver. It is important to note that, according to Qantas Airlines, very little air cargo actually originates in Hawaii. Therefore, Honolulu airport itself acts as an air cargo hub for the goods being trans-shipped from the mainland to Australia and other locations in the Pacific.

As Table 2 shows, 4 out of the top 5 international airports for Hawaii-bound air cargo were Japanese airports: Tokyo-Narita, Tokyo-Haneda, Kansai, and Nagoya. The other location was Seoul-Incheon, in the fourth place.

A majority of Hawaii's domestic outbound air cargo goes to California airports. The only non-California airport in the top 5 domestic destinations was Dallas/Fort Worth, TX.

Table 2: Air Cargo in Hawaii Ranked by the Airport of Origin and Destination, 2016

	Top 5 Airports of Cargo Origin in 2016 – International (Inbound)		
	Airport	**Route**	**Freight, tons**
1	Tokyo-Narita, Japan	NRT-HNL	25,699
2	Tokyo-Haneda, Japan	HND-HNL	9,952
3	Kansai, Japan	KIX-HNL	8,654
4	Seoul-Incheon, Republic of Korea	ICN-HNL	7,877
5	Nagoya, Japan	NGO-HNL	4,601
		Top 5 Total	56,783 (or 75.7%)
	Top 5 Airports of Cargo Origin in 2016 – Domestic (Inbound)		
1	Los Angeles, CA	LAX-HNL	94,831
2	Ontario, CA	ONT-HNL	43,718
3	Memphis, TN	MEM-HNL	40,009
4	Louisville, KY	SDF-HNL	24,832
5	Chicago, IL	ORD-HNL	18,877
		Top 5 Total	222,267 (or 79.4%)
	Top 5 Airports of Cargo Destination in 2016 – International (Outbound)		
1	Sydney, Australia	HNL -SYD	55,540
2	Auckland, New Zealand	HNL-AKL	12,791
3	Hong Kong, China	HNL-HKG	4,274
4	Tokyo-Narita, Japan	HNL-NRT	3,133
5	Vancouver BC, Canada	HNL-YVR	2,773
		Top 5 Total	78,512 (or 92.4%)
	Top 5 Airports of Cargo Destination in 2016 Domestic (Outbound)		
1	Los Angeles, CA	HNL-LAX	64,972
2	Oakland, CA	HNL-OAK	15,027
3	Ontario, CA	HNL-ONT	12,834
4	San Francisco, CA	HNL-SFO	6,355
5	Dallas/Fort Worth, TX	HNL-DFW	4,821
		Top 5 Total	104,009 (or 76.1%)

Source: DBEDT calculations based on data from the United States Department of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017)

E. Top Air Cargo Carriers in Hawaii. Table 3 ranks the airlines and provides their air cargo market share for Hawaii in 2016.

Table 3: Top Air Cargo Carriers in Hawaii, 2016

Rank	Airline	Cargo Freighted	Market Share
Top 5 Air Cargo Carriers: Outbound From Hawaii			
1	Fedex	49,588	20.17%
2	UPS	36,915	15.01%
3	Kalitta Air	25,367	10.32%
4	Atlas Air	23,123	9.41%
5	Hawaiian Airlines	21,704	8.83%
	top 5 total market share - outbound:		***63.74%***
Top 5 Air Cargo Carriers: Inbound To Hawaii			
1	Fedex	69,155	18.30%
2	UPS	68,059	18.01%
3	Hawaiian Airlines	50,596	13.39%
4	Kalitta Air	33,645	8.90%
5	Atlas Air	22,975	6.08%
	top 5 total market share -inbound:		***64.68%***
Top 5 Air Cargo Carriers: Inter-Island			
1	Aloha Air Cargo	40,987.62	40.45%
2	Rhoades Aviation/Transair Cargo	15,896.08	15.69%
3	UPS	15,017.65	14.82%
4	Hawaiian Airlines	6,432.79	6.35%
5	Fedex	2,860.71	2.82%
	top 5 total market share - inter-island:		***80.13%***

Source: DBEDT calculations based on data from the United States Department of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017)

As seen in Table 3, while both Hawaii inbound and outbound air cargo markets are somewhat competitive, the inter-island air cargo market is largely served by two Hawaii-based airlines: Aloha Air Cargo and Transair (Rhoades Aviation). Fedex, the top airline for both Hawaii inbound and outbound air cargo, is a relatively small player in the inter-island air cargo market, accounting for under 3 percent of the market.

The top 5 airlines for both Hawaii inbound and outbound air cargo markets are, along with Fedex and UPS, Kalitta Air, Atlas Air, and Hawaiian Airlines. As noted earlier, the volume of inbound cargo is significantly higher than outbound cargo for Hawaii. Another point worth mentioning is that the Hawaiian Airlines has both cargo and passengers, while the other four airlines report only cargo. In addition, the data show that Kalitta Air and Atlas Air often serve US military bases in Hawaii, along with delivering and picking up other (non-military) air cargo.

III. Jobs in Air Cargo Industry in Hawaii

The tremendous growth of Hawaii's air cargo volumes between 2002 and 2016 was correlated with the air cargo related job growth. Table 4 lists the job growth for the industries of scheduled freight (NAICS 481112) and nonscheduled chartered freight air transportation (NAICS 481212).

Table 4: Jobs in Air Cargo Industry in Hawaii, 2001 - 2016

Occupation	Number of Jobs (2016)	Job Growth (2001-2016)	Median Hourly Wage
Flight Attendants	194	1,663.6%	$28.20
Pilots	149	684.2%	$64.27
Ticket Agents and Travel Clerks	115	2,200.0%	$16.04
Mechanics and Technicians	71	545.5%	$30.39
Laborers and Movers	45	2,150.0%	$12.96
Miscellaneous Transportation Workers	37	1,750.0%	$16.65
Cargo and Freight Agents	33	1,550.0%	$14.24
Air Traffic Controllers	21	950.0%	$27.65
First-Line Office Supervisors	18	1,700.0%	$24.82
Customer Service Representatives	12	1,100.0%	$16.87
First-Line Mechanics Supervisors	11	450.0%	$35.19
Others	147	-	$27.85
		average job growth in the industry:	***weighted average pay:***
State Total:	**852**	**978.5%**	**$37.47**

Source: EMSI, Hawaii Department of Labor and Industrial Relations, Research and Statistics Office

The large job increases for the scheduled and nonscheduled air freight transportation categories reflects the growth of the industry. The average increase across different categories of jobs supporting the air cargo industry is about 979 percent for the 2001 to 2016 period.

Working in the air cargo industry is also a relatively well paid endeavor, with a weighted average hourly pay at around $37. The median pay ranges from a low of about $13 an hour paid for the laborers and material movers (or about $27,000 a year) to a high of above $64 an hour paid to air cargo pilots (or about $133,000 a year). Pilots are the second largest category of jobs in the air cargo industry in Hawaii.

IV. Value and Composition of Hawaii Air Cargo

One of the challenges of analyzing Hawaii's air freight industry is to calculate the value of goods shipped. One of the few data sources that tracks the value of goods shipped is the Freight Analysis Framework (FAF4), which is based on data from the Bureau of Transportation Statistics. FAF4 has data on both cargo volumes and value. Using the FAF4 data analysis toolkit and extrapolating it to Hawaii-specific data on flights and cargo volumes, Table 5 breaks down the value of air cargo to and from Hawaii. This is based on the total tonnage from the FAF4 database. Unfortunately, FAF4 data is limited to 2015, so 2015 data is used by DBEDT also in order to be consistent. It is important to note this is the value of goods per the invoice value and not the cost of transportation.

Table 5: Value of Air Cargo Shipments to and from Hawaii, 2015

	Value of Air Cargo:		
	per ton	**per kg**	**per lb**
Inbound to Hawaii	$28,015.98	$28.02	$14.01
Outbound from Hawaii	$25,380.79	$25.38	$12.69
Inter-Island	$32,516.93	$32.52	$16.26

Source: Data from the Freight Analysis Framework Version 4.4, US Dept. of Transportation, Calculations by DBEDT

Applying this data to the actual flight data from the Bureau of Transportation Statistics on flight patterns and capacity, Table 6 summarizes the total values for air cargo freighted in and out of Hawaii as well as inter-island shipments.

Table 6: Total Value of Air Cargo Shipments to, from and in Hawaii, 2015

2015 Value of Hawaii Air Cargo				
	Volume (tons)	Air Cargo as Percent of All Cargo in Hawaii*	Value	Value of Air Cargo as Percent of Total Cargo Value*
Inbound	372,300.64	8.08%	$10,430,366,185	20.9%
Outbound	250,534.56	18.44%	$6,358,766,026	21.8%
Inter-Island	92,450.29	0.24%	$3,006,199,622	11.9%

*Values do not sum up to 100% across categories

Source: Data from the Freight Analysis Framework Version 4.4, US Dept. of Transportation, Bureau of Transportation Statistics, *U.S. Air Carrier Traffic and Capacity* (2017); Calculations by DBEDT

While air cargo accounts about 8 percent of Hawaii's total inbound cargo weight and about 18 percent of all outbound cargo weight, it comprises approximately 21 percent of the total value of cargo shipped for both inbound and outbound (including air and ocean). Inter-island air cargo shipments account for less than ¼ of a percent, but about 12 percent in value of the total cargo shipped within Hawaii.

Hawaii data is similar to overall global trends for air cargo: world air cargo accounts less than 1 percent of all cargo tonnage, yet represents 35 percent of world trade value. Air cargo is a high value industry and it serves markets that demand speed and reliability for the transport of goods. The highest value commodities, including computer equipment, machinery and electrical equipment, account for the highest share of airborne trade tonnage versus their share of ocean containership tonnage. Air cargo will remain a priority choice for shipping higher value goods, especially the ones that are time-sensitive and perishable (Crabtree, et al., 2016).

Analyzing ***the composition of air cargo goods*** transported to and from Hawaii, Table 7 below lists the top 10 categories of goods shipped to Hawaii by air, ranked by total value. The total market value for the top 10 categories of goods shipped to Hawaii in 2015 was a little over $3.1 billion. However, the value of international goods shipped to Hawaii from international locations was much smaller, at $143.6 million.

For air cargo moved between North America and Asia, there are three commodity categories accounting for 60.9 percent of the air cargo traffic: apparel, telecommunication equipment, and electrical machinery and apparatus, while in the reverse Asia-to–North America flow, the share of Asia's exports represented by the apparel category grew 5.6 percent in 2015. (Crabtree, et al., 2016).

As noted in the section above, the total volume of international air cargo shipped to Hawaii was 76,710.76 tons, while the volume of domestic air cargo shipped to Hawaii nearly 4 times higher, at 285,270.18 tons. In addition to pure volume difference, goods shipped from domestic destinations to Hawaii are much higher in value (Table 7).

Table 7: Top 10 Categories of Goods Shipped by Air to Hawaii, 2015

Rank by value	Category of Goods, domestic	Current $	Category of Goods, International	Current $
1	Electronics	$730,065,100	Exports of Repaired/Returned Imports	$42,348,152
2	Precision instruments	$570,044,100	Handbags, Wallets, Jewelry Cases	$23,363,259
3	Miscellaneous manufactured products	$399,529,200	Jewelry & Precious Metal	$21,486,086
4	Machinery	$330,066,300	Watches, Wrist, Pocket	$14,690,462
5	Motorized vehicles	$278,462,500	Fish, Fresh Or Chilled	$13,497,163
6	Transport equipment	$258,786,900	Computers and Parts	$8,118,879
7	Textiles/leather	$175,352,100	Art Paintings, Drawings	$6,467,420
8	Pharmaceuticals	$163,068,800	Seats And Parts	$4,697,050
9	Articles-base metal	$102,334,600	Medical, Surgical, Dental Equipment	$4,485,567
10	Meat/seafood	$101,938,200	Pearls, Natural Or Cultured	$4,452,069
	Total Top 10 Domestic	**$3,109,647,700**	**Total Top 10 International**	**$143,606,107**

Source: Data on Domestic Shipping is from the Freight Analysis Framework Version 4.4, US Dept. of Transportation, Bureau of Transportation Statistics; Data on International Shipping is from the U.S. Census Bureau Foreign Trade Division

In looking at outbound air cargo from Hawaii, the value of goods is a bit more balanced between global and domestic. For both domestic and international, there is more food-related products being shipped out including processed food, agriculture, and aquaculture.

Table 8: Top 10 Categories of Goods Shipped by Air from Hawaii, 2015

Rank by value	Category of Goods, domestic	Current $	Category of Goods, International	Current $
1	Mixed freight	$343,643,000	Parts Of Aircraft	$396,962,737
2	Pharmaceuticals	$253,758,300	Turbojets, Turbo-propellers	$32,165,982
3	Other foodstuffs	$241,557,600	Electric Telephone Parts	$19,976,303
4	Meat/seafood	$113,385,000	Crustaceans Live Fresh	$19,950,092
5	Other ag prods.	$87,202,300	Aircraft, Engines, And Parts	$11,909,737
6	Textiles/leather	$86,370,000	Military Apparel & Equipment	$10,858,591
7	Alcoholic beverages	$81,891,800	Parts & Accessories	$9,583,937
8	Other foodstuffs	$77,889,500	Tank & Armored Fight Vehicles	$8,159,265
9	Printed products	$75,709,000	Melons And Papayas, Fresh	$7,557,203
10	Electronics	$65,834,500	Coffee and Coffee Husks	$6,857,073
	Total for Top 10 Domestic:	**$1,427,241,000**	**Total for Top 10 International**	**$523,980,920**

Source: Data on Domestic Shipping is from the Freight Analysis Framework Version 4.4, US Dept. of Transportation, Bureau of Transportation Statistics; Data on International Shipping is from the U.S. Census Bureau Foreign, Trade Division

Part of the explanation for the similar value of outbound shipments for domestic and international is that there is also less of an imbalance in volume. The total volume of air cargo shipped from Hawaii in 2015 to international destinations was 96,032.57, while outbound cargo shipped from Hawaii to domestic destinations in 2015 was 144,044.62. Table 8 shows top 10 categories of goods shipped from Hawaii to both domestic and international destinations, ranked by value.

V. Future Outlook for Air Cargo

Hawaii is well positioned for the future growth of the air cargo industry. Since Hawaii serves as a link between the North American and the Asia Pacific markets, Honolulu airport will continue to play a pivotal role in global trade.

According to Boeing, air cargo is closely linked to global trade and industrial production. The reason for sluggish air cargo growth, between 2011 and 2015, was a weak global economy which inhibited global trade growth.

However, ***global e-commerce is expected to more than double over the next five years***, growing from $1.7 trillion to $3.6 trillion by 2020 (Crabtree, et al., 2016). As noted earlier, according to the US Census Bureau, e-commerce sales in the US have grown by nearly 28 percent per year on average over the last 15 years (US Census, 2017).

Online shopping still accounts for a relatively low share of global retail sales, only 7.4 percent in 2015. However, the global online retail market is forecast to continue rapid growth into the future. It is expected to reach $3.58 trillion in sales by 2019, with the share of global retail sales gradually rising to 12.8 percent (Crabtree, et al., 2016).

The region of the world that shows the highest potential for e-commerce growth is the Asia-Pacific region, with China responsible for the largest part of this growth. In 2015, the growth of online retail sales in the two developed markets of North America and Europe was significantly lower than other regions of the world. On the other hand, online retail sales of the Asia-Pacific region rose by nearly 30 percent year-over-year, accounting for over 50 percent of global online retail for the first time. The continuous increase in the number of online shoppers and the increase of purchasing power have become the major driving force for continuous online retail sales growth in the Asia Pacific region (Crabtree, et al., 2016).

Once FedEx started its operations in 1971, it led to the profound changes in how express packages are delivered, beginning a nationwide door-to-door delivery of documents and small packages within one to two days. Late 1990s and early 2000s brought with them very high rates of growth in e-commerce demand for business to consumer (B2C) as well as business to business (B2B) deliveries of retail purchases. These development will contribute to the radical changes in the freight transportation. The major express carriers, including UPS, DHL, and FedEx serve e-commerce flows. Amazon has begun building its own logistics network to augment capacity provided by others (Crabtree, et al., 2016).

Boeing predicts that over the next 20 years, world air cargo traffic will grow 4.2 percent per year, more than doubling in its size over the next 20 years. Air freight, including express traffic, will average 4.3 percent annual growth. Airmail traffic will grow at a slower pace, averaging 1.7 percent annual growth through 2035 (Crabtree, et al., 2016).

Air cargo markets linked to Asia, especially the Pacific Rim, with Hawaii serving as a link to these destinations, will lead all other international markets in average annual growth between 2015 and 2035. Boeing predicts markets in Asia will continue to lead the world for average annual air cargo growth, with domestic China and intra-Asia markets expanding 6.2 percent and

5.5 percent per year, respectively. Hawaii benefits from being a link between North America and Asia Pacific.

Although generally the future for air cargo looks bright, there are risk factors that could influence air cargo volumes including changes in inventory management techniques, environmental regulations, globalization, market liberalization, national development programs, and the introduction of new air-eligible commodities. Furthermore, contraction of the global economy could constrain air cargo growth. (Crabtree, et al., 2016).

Another risk for the air cargo industry is the potential rise in ***fuel prices***. Oil prices fluctuated significantly over the past few years, but have been relatively stable recently. Lower fuel prices decrease operating costs, which improves operating margins. While there are various price forecasts, some expect crude oil prices to rise gradually in the next few years (Crabtree, et al., 2016) and this could hinder operating margins for air cargo carriers.

Competition with other modes of transportation is another major issue for air cargo. Greater efficiencies in the containership industry have attracted more shippers to move their freight by water, instead of air. It is generally 10 to 20 times less expensive to ship a container by water than by air as measured in per unit weight, but transit times are longer and less reliable than air cargo. The goods that are shipped by air are high value, time sensitive, and perishable. To continue to compete effectively with containerships, the air cargo industry must ensure that the service benefits of air transportation warrant the price premium charged (Crabtree, et al., 2016).

References

Amazon, Annual Shareholder Filings, 1998 Annual Report

Amazon, Annual Shareholder Filings, 2002 Annual Report, source:http://media.corporate-ir.net/media_files/irol/97/97664/reports/2002_Annual_Report_FINAL.pdf

Business Insider Magazine - States Where People Spend The Most Money When Buying Things Online, http://www.businessinsider.com/online-spending-habits-2012

Crabtree, T., T. Hoang, R. Tom, G. Gildemann (2016). *World Air Cargo Forecast*. Boeing Corporation, October.

GLD Partners (2014). *AIAS Air Cargo Related Economic Development.* Anchorage Economic Development Corporation. January.

Hawaii Department of Business Economic Development and Tourism (2017). Passengers, Cargo, and Mail, Overseas and Inter-Island, by Airport: 2016. State of Hawaii Data Book. Table 18.38

Kasarda, J., D. Sullivan (2006). *Air Cargo, Liberalization, and Economic Development.* Annals of Air Space and Law, Volume XXXI. May.

Kupfer, F., H. Meersman, E. Onghena, E. Van de Voorde (2009). *Air Cargo: The Difference Between Success and Failure?* Association for European Transport.

Lee, Y. (2007). *Airlines Strategy on Air Cargo Business and Its Open Sky in Asia.* Presentation at International Transport Policy Research Unit 2nd International Seminar. March.

Qantas Airlines (2017). *Qantas Puts the New Kangaroo Route on Sale.* Qantas Newsroom, *https://www.qantasnewsroom.com.au/topic/network/page/2/*

Scharpenseel, M.F. (2001). *Consequences of E.U. Airline Deregulation in the Context of the Global Aviation Market.* Northwestern Journal of International Law and Business. Volume 22. Fall.

Shepherd, B., A. Shingal, A. Raj (2016). *Value of Air Cargo: Air Transport and Global Value Chain.* Developing Trade Consultants. December.

U.S. Congress. (1980). *Impact of Advanced Air Transport Technology.* Ch. 2. An Overview of the Air Cargo System. Office of Technology Assessment. January.

U.S. Census Bureau (2017). Foreign Trade Division.

U.S. Census Bureau (2017). Retail trade in United States and E-Commerce.

U.S. Department of State (2017). *Open Skies Partnerships: Expanding the Benefits of Freer Commercial Aviation.* Fact Sheet. July.