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16. Abstract

Air cargo transport has become particularly important in today's expanding global economy for the movement of high-value goods such as electronics, computer components, precision equipment, medical supplies, auto parts, and perishables. Air cargo operations allow fast, frequent, and predictable transit as an increasing number of companies out-source manufacturing to remote locations of the world. Decreasing product cycles for high-value, high-technology goods have made fast delivery to markets essential. In addition, local industries have become global traders, who can reach consumers worldwide.

This report examines the potential of Texas-based airports, especially Dallas-Ft. Worth International Airport and the Houston Airport System, to emerge as international gateways for global trade in general and trans-Pacific trade in particular. The period covered is 2001 to 2006.

The report is composed of four chapters. The first chapter examines global, U.S., and Texas air cargo trends. The second chapter addresses air freight performance and activities at Texas airports. The third chapter discusses the relationship between air cargo/passenger operations and their impacts on local economic development. The final chapter discusses the policy implications for the State of Texas.

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International Air Cargo Operations and Gateways: Their Emerging Importance to the State of Texas

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EXECUTIVE SUMMARY

International merchandise trade has experienced rapid growth due to the globalization of manufacturing. Because worldwide economic growth tends to be much more stable than that associated with any individual country, the international air cargo industry has experienced steadier demand for its services than domestic operations. The growth in air freight is particularly evident on trans-Pacific routes linking U.S. origins and destinations with those of China, Japan, and Korea where high-tech manufacturers and time-sensitive shippers are locating their operations to sites accessible to major airports for the transportation of telecommunications equipment, information technology, medical equipment pharmaceuticals, software, and the like.

The search for Asian and U.S. air cargo hubs is turning into a high-stakes battle for capturing future air freight flows across the Pacific Ocean. This is driving substantial investments in the surrounding regions of major airports. And the jobs in time-sensitive industries that depend upon air cargo transport tend to be higher-paying than most other industrial sectors. These trends are evident at Dallas-Fort Worth International Airport (DFW). In 2005, international air cargo accounted for 33.6 percent of all cargo at DFW. Asian cargo increased 2000 percent since 1993 and presently makes up nearly two-thirds, or 61 percent, of DFW's total international cargo of which China accounts for 16.5 percent, Taiwan 20.9 percent, South Korea 10.3 percent, and Japan much of the remainder.

In order to attract more air freight traffic, DFW has expanded its air freight facilities. Trammell Crow opened a newly-built 35-acre cargo center, comprised of 395,000 sq. ft. of air cargo, logistics, and freight forwarding office and warehouse space. An additional 350,000 sq. ft. of ramp space, 118,000 sq. ft. of warehouse space and 275,000 sq. ft. of logistics space was recently completed.

The Houston Airport System (HAS) represents another example of these growth trends where international air cargo accounts for 42.5 percent of all air cargo. In January 2003, George Bush International Airport (IAH) opened a $140 million cargo facility that attracted United Parcel Service (UPS) and Federal Express (FedEx) to 500,000 sq. ft. of warehouse space. Soon after, Continental Airlines invested $30 million in a new facility to handle Asian and European traffic. HAS and the Shanghai Airport Authority signed a cooperation agreement to promote air cargo trade and economic development between their airport systems and respective regions. And, during 2007, China Airlines Cargo, Korea Air Cargo, EVA Air Cargo, Singapore Airlines, and Continental Airlines launched or announced 42 additional weekly flights from Houston and introduced air cargo service from Houston to Korea, Taipei, and Singapore, among other destinations.

This report is composed of four chapters. The first chapter examines international, U.S., and Texas air cargo trends. The second chapter addresses air freight performance and activities at Texas airports. The third chapter discusses the relationship between air cargo operations and regional economic development impacts. And, finally, the last chapter evaluates the potential of future international air cargo and its policy implications for the State of Texas.

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CHAPTER 1. GLOBAL AND UNITED STATES AIR CARGO TRENDS

International Air Freight Performance by Service Type

The U.S. Bureau of Transportation Statistics (BTS) reports two types of annual freight statistics as measurements of performance: segment-based statistics and market-based statistics. Segment-based statistics only apply to non-stop air freight (cargo) transport between U.S. airports and airports in other countries. On the other hand, market-based statistics apply to air freight volume between an airport of origin and the final-destination airport that may entail intermediate stops and the use or more than one aircraft. As such, this latter measurement provides the real volume of air freight transport performed in a given country, state, airport.

Air freight transport also can be classified as either scheduled service or non-scheduled service. According to BTS's definition,[1] scheduled service operates pursuant to published flight schedules, including extra sections and related non-revenue flights, while non-scheduled service involves revenue flights, such as charter flights[2], that are not operated on a scheduled base. Both scheduled and non-scheduled services again can be included in passenger/cargo combination aircraft and all cargo aircraft. Therefore, there are four types of air services; scheduled passenger/cargo combination flight service; scheduled all cargo flight service, non-scheduled passenger/cargo combination flight service; and non-scheduled all cargo flight service.

As shown in Table 1, passenger/cargo combination service (F) experienced a decrease in tonnage over the period of 2001-2005, while both scheduled and non-scheduled all cargo services (G and P) experienced steady and rapid growth over the same time period. Air freight carried by scheduled passenger/cargo combination service (F) amounted 3.1 million tons, the highest performance in its history in 2000. But it decreased to around 2.6 million tons in 2005 by experiencing a negative 0.2 percent average annual decline in market-based air freight and a negative 0.3 percent decline in segment-based air freight. Consequently, its market-based air freight share in total air freight decreased from 40.8 percent in 2001 to 32.2 percent, and its segment-based air freight share in total U.S. air freight performance decreased to 30.1 percent in 2005, down from 37.6 percent in 2001.

On the other hand, market-based air freight performance of scheduled all cargo service (G) grew by 4.2 percent annually, from 3.4 million tons in 2001 to 4.0 million tons in 2005. And segment-based air freight performance of scheduled all cargo service (G) showed an average annual growth rate of 3.5 percent. Its air freight performance grew to 4.5 million tons in 2005, up from 4.0 million tons in 2001. Although these growth rates were much lower than the average annual air freight growth rate of 8.4 percent between 1990 and 2000, they still showed steady growth trends. Nevertheless, its share of total U.S. market-based air freight performance decreased slightly from 51.5 percent in 2001 to 48.6 percent in 2005. In addition, its share of total segment-based air freight also decreased from 54.8 percent in 2001 to 51.0 percent in 2005. These decreases in share of total U.S. air freight performance may be caused by rapid growth of non-scheduled all cargo services in both air freight measurements.

Non-scheduled all cargo service (P) grew more than three times between 2000 and 2005 in both market and segment-based air freight measurements. By recording an average annual growth rate

of 33.4 percent, market-based air freight performance of non-scheduled all cargo service grew to 1.6 million tons in 2005, up from 491,000 tons in 2001. And its segment-based air freight performance expanded by 32.8 percent, up from 529,000 tons in 2001 to 1.6 million tons in 2005. Its share of total market-based air freight performance, consequently, grew from 7.5 percent in 2001 to 19.0 percent in 2005. Similarly, its share in total segment-based air freight performance expanded from 7.4 percent in 2000 to 18.6 percent in 2005. This rapid growth of non-scheduled all cargo service was made possible because scheduled services were seriously affected by the 9/11 New York City terrorist attack. In addition, these non-scheduled all cargo services attracted air freight by adopting low cost services. It should be noted that non-scheduled all cargo services recorded positive growth even in 2001.

Non-scheduled passenger/cargo combination services also recorded rapid growth rates of 18.5 percent in market-based air freight measurements and 17.2 percent in segment-based air freight measurements. However, their shares of the total air freight market were low because they used relatively small-capacity aircraft.

Table 1: Air Freight Performance by Service Type: 1990-2005 (1000 tons, %)

Measure	Type	1990	2000	2001	2002	2003	2004	2005	90-00	01-05
Market	Total	3,504 (100.0)	7,017 (100.0)	6,548 (100.0)	6,940 (100.0)	7,163 (100.0)	7,987 (100.0)	8,210 (100.0)	7.2	5.8
	F	1,629 (46.5)	3,083 (43.9)	2,669 (40.8)	2,565 (37.0)	2,430 (33.9)	2,642 (33.1)	2,643 (32.2)	6.6	-0.2
	G	1,533 (43.7)	3,436 (49.0)	3,376 (51.5)	3,616 (52.1)	3,665 (51.2)	3,845 (48.1)	3,986 (48.6)	8.4	4.2
	L	7 (0.2)	15 (0.2)	13 (0.2)	12 (0.2)	18 (0.2)	14 (0.2)	25 (0.3)	8.6	18.5
	P	324 (9.2)	483 (6.9)	491 (7.5)	747 (10.8)	1,051 (14.7)	1,487 (18.6)	1,556 (19.0)	4.1	33.4
Segment	Total	3,958 (100.0)	7,651 (100.0)	7,164 (100.0)	7,518 (100.0)	7,672 (100.0)	8,607 (100.0)	8,848 (100.0)	6.8	5.4
	F	1,804 (45.6)	3,124 (40.8)	2,695 (37.6)	2,591 (34.5)	2,446 (31.9)	2,674 (31.1)	2,664 (30.1)	5.6	-0.3
	G	1,780 (45.0)	3,983 (52.1)	3,928 (54.8)	4,189 (55.7)	4,170 (54.4)	4,344 (50.5)	4,513 (51.0)	8.4	3.5
	L	6 (0.2)	17 (0.2)	13 (0.2)	12 (0.2)	18 (0.2)	15 (0.2)	25 (0.3)	10.5	17.2
	P	356 (9.0)	526 (6.9)	529 (7.4)	726 (9.7)	1,039 (13.5)	1,573 (18.3)	1,646 (18.6)	4.0	32.8

Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: Jan. 2007.

Note: F= scheduled passenger/cargo combination flight service, G= scheduled all cargo flight service, L= non-scheduled passenger/cargo combination flight service, and P= non-scheduled all cargo flight service.

Tables 2 and 3 show air freight performance of air carriers in each service group. Air freight performance of scheduled passenger/cargo combination service mainly consisted of U.S. and European air carriers such as American Airlines, British Airways, United Airlines, Delta Air Lines, Lufthansa German Airlines, Continental Air Lines, Northwest Airlines, Compagnie National Air France, Virgin Atlantic Airways, KLM Royal Dutch, and so on. There were only two Asian air carriers—EVA Airways and Japan Airlines—in the top-15 scheduled passenger/cargo combination service providers. On the other hand, the top-15 scheduled all cargo service providers consisted of eight Asian air carriers, four U.S. air carriers (including UPS and FedEx), two European air carriers, and one Latin American air carrier. Among scheduled all cargo service providers, FedEx ranked first, followed by UPS, Korean Air Lines, China Airlines, EVA Airways, Japan Airlines, Polar Air Cargo Airways, and so on. These results show that Asian air carriers are more focused on all cargo flight services, while U.S. and European air carriers tend to emphasize passenger/cargo combination flight services.

In both scheduled and non-scheduled passenger/cargo combination services, exactly the same air carriers are listed regardless of the performance measurement method used. In scheduled passenger/cargo combination service, American Airlines occupied the first place by handling 366,000 tons of air freight, followed by British Airways, United Airlines, Delta Air Lines, Lufthansa German Airlines, Continental Airlines, Northwest Airlines, Compagnie National Air France, Virgin Atlantic Airways, KLM Royal Dutch, and so on.

These top-scheduled passenger/cargo combination service providers, however, achieved relatively low growth rates or experienced even negative growth over the 2001-2005 time period. American Airlines, British Airways, Lufthansa Airlines, Continental Airlines, Northwest Airlines, and Eva Airways showed positive growth; but, with 3.9 percent growth rates, they were lower than the average growth rate of 5.8 percent. Other scheduled passenger/cargo combination service providers such as United Airlines, Delta Airlines, Virgin Atlantic Airways, KLM Royal Dutch Airlines, US Airways, Japan Airlines, and Swiss International Airlines recorded negative growth over the same time period. Among them, U.S. Airways recorded the largest decrease of 6.9 percent.

Most of the top scheduled all cargo service providers recorded higher growth rates compared to average air freight growth rates for the U.S. between 2001 and 2005. In particular, Asian air carriers such as Korean Airlines, China Airlines, EVA Airways, Japan Airlines, Singapore Airlines, Cathay Pacific Airways, Asiana Airlines, and Nippon Cargo Airlines grew much faster than the average air freight performance growth of 3.5 percent. Singapore Airlines and Cathay Pacific Airways recorded exceptionally higher growth rates—more than 20 percent—for the period of 2001-2005. In 2005, Singapore Airlines grew to 179,000 tons under both measurements, while Cathay Pacific Airways increased its air freight volume to 140,000 tons in market-based air freight and to 166,000 tons in segment-based air freight.

Other scheduled all cargo service providers such as Federal Express, United Parcel Service, Transportes Aereos Merchantiles, and Cargolux Airlines International S.A. recorded moderate growth rates—between 4.0 percent to 5.4 percent—over the same time period. But their growth rates were still higher than the average air freight growth rate of the U.S. FedEx, the top air

freight carrier, carried 496,000 tons of market-based air freight, and 657,000 tons of segment-based air freight.

Both non-scheduled passenger/cargo combination service and non-scheduled all cargo service also experienced higher growth rates. Omni Air Express, a non-scheduled passenger/cargo combination service operator, recorded 195.7 percent annual growth in the market-based traffic and 458.2 percent in the segment-based traffic.

On the other hand, non-scheduled all cargo service providers such as Cielos De Peru, Gemini Air Cargo, World Airways, Kalitta Air LLC, and Air Atlanta Icelandic recorded nearly 100 percent or even more than 200 percent annual growth in both market- and segment-based air freight. Atlas Air, the leading non-scheduled all cargo service seller, carried 372,000 tons of air freight under both measurements.

Table 2: Market-based Air Freight Performance by Service and Air carrier (1000 tons)

		1990	1995	2000	2001	2002	2003	2004	2005	01-05 (%)
Rank	Total	3,504	5,274	7,017	6,548	6,940	7,163	7,987	8,210	5.8
-	F Total	1,629	2,349	3,083	2,669	2,565	2,430	2,642	2,643	-0.2
1	American Airlines Inc.	112	296	352	324	326	315	357	366	3.0
2	British Airways Plc	161	190	262	209	216	220	241	233	2.8
3	United Air Lines Inc.	61	200	292	262	255	195	198	233	-2.9
4	Delta Air Lines Inc.	49	138	222	192	181	156	178	171	-2.9
5	Lufthansa German Airlines	142	111	155	139	139	132	154	160	3.5
6	Continental Air Lines Inc.	73	46	160	128	130	131	153	144	3.0
7	Northwest Airlines Inc.	63	89	120	94	98	87	100	102	2.0
8	Compagnie Nat'l Air France	53	68	91	93	80	81	87	97	1.0
9	Virgin Atlantic Airways	29	61	112	100	86	87	93	93	-1.8
10	Klm Royal Dutch Airlines	96	148	112	102	95	95	95	92	-2.6
11	Eva Airways Corporation	-	66	60	46	54	55	51	54	3.8
12	US Airways Inc.	9	14	55	68	71	66	65	51	-6.9
13	Japan Air Lines Co. Ltd.	52	61	77	51	53	49	57	49	-0.8
14	Scandinavian Airlines Sys.	31	33	50	44	45	51	45	46	1.2
15	Swiss International Airlines	-	-	-	-	48	63	51	42	-4.6
-	G Total	1,533	2,218	3,436	3,376	3,616	3,665	3,845	3,986	4.2
1	United Parcel Service	17	149	379	446	479	452	479	530	4.4
2	Federal Express Corporation	-	-	422	491	497	489	532	496	0.3
3	China Airlines Ltd.	44	65	179	172	201	208	256	270	11.9
4	Korean Air Lines Co. Ltd.	143	166	221	187	237	241	271	236	6.0
5	Eva Airways Corporation	-	25	117	111	151	177	230	229	19.8
6	Polar Air Cargo Airways	-	55	112	112	162	217	233	188	13.8
7	Singapore Airlines Ltd.	-	34	80	79	112	130	160	179	22.4
8	Northwest Airlines Inc.	124	144	157	154	163	176	192	170	2.4
9	Japan Air Lines Co. Ltd.	143	110	121	106	118	115	132	140	7.2
10	Cathay Pacific Airways Ltd.	-	22	63	64	90	104	129	140	21.5
11	Transportes Aereos Mercantiles	5	97	121	109	102	122	137	133	5.2
12	Asiana Airlines Inc.	-	-	112	93	118	121	119	130	8.7
13	Nippon Cargo Airlines	62	89	105	87	109	115	119	125	9.4
14	Compagnie Nat'l Air France	77	90	80	62	68	77	87	90	9.8
15	Cargolux Airlines Int'l S.A	-	59	81	87	66	61	12	87	0.0
-	L Total	7	17	15	13	12	18	14	25	18.5
1	Omni Air Express	-	-	-	-	0	0	3	10	195.7
2	Air Atlanta Icelandic	-	-	-	-	2	8	2	4	23.8
3	Airtours Int'l Airways	-	2	6	5	3	2	3	2	-15.1
4	Air Atlanta Europe	-	-	-	-	-	-	2	2	29.4
5	United Air Lines Inc.	-	0	-	-	-	-	1	2	61.6
-	P Total	324	686	483	491	747	1,051	1,487	1,556	33.4
1	Atlas Air Inc.	-	4	113	147	211	398	416	372	26.0
2	Centurion Cargo Inc.	2	-	-	-	15	60	93	196	133.1
3	Cielos De Peru	-	-	-	-	20	61	140	151	94.8
4	Gemini Air Cargo Airways	-	-	22	50	112	82	184	122	25.1
5	Korean Air Lines Co. Ltd.	2	6	75	77	56	68	92	109	9.0
6	World Airways Inc.	11	1	6	6	35	36	63	105	101.5
7	Kalitta Air LLC	-	-	-	6	20	48	81	83	96.3
8	Southern Air Inc.	-	-	5	55	64	15	54	70	5.9
9	Air Atlanta Icelandic	-	-	-	-	0	-	29	55	462.7
10	Polar Air Cargo Airways	-	1	15	11	0	-	47	55	48.3

Data: BTS website, Accessed: January 2007.

Table 3: Segment-based Air Freight Performance by Service and Air carrier (1000 tons)

Rank	Index	1990	1995	2000	2001	2002	2003	2004	2005	01-05 (%)
-	Total	3,958	5,587	7,651	7,164	7,518	7,672	8,607	8,848	5.4
	F Total	1,804	2,367	3,124	2,695	2,591	2,446	2,674	2,664	-0.3
1	American Airlines Inc.	112	296	352	324	326	315	357	366	3.0
2	British Airways Plc	170	190	262	209	216	220	241	233	2.8
3	United Air Lines Inc.	61	200	292	262	255	195	216	233	-2.9
4	Delta Air Lines Inc.	49	138	222	192	181	156	178	171	-2.9
5	Lufthansa German Airlines	158	111	155	139	139	132	154	160	3.5
6	Continental Air Lines Inc.	74	46	160	128	130	131	153	144	3.0
7	Northwest Airlines Inc.	63	89	120	94	98	87	100	102	2.0
8	Compagnie Nat'l Air France	87	70	92	95	82	83	89	99	1.1
9	Virgin Atlantic Airways	29	61	112	100	86	88	93	93	-1.8
10	Klm Royal Dutch Airlines	127	148	112	102	95	95	95	92	-2.6
11	Eva Airways Corporation	-	62	61	46	54	55	51	54	3.9
12	US Airways Inc.	9	14	55	68	71	66	65	51	-6.9
13	Japan Air Lines Co. Ltd.	68	61	78	52	54	51	58	50	-1.0
14	Scandinavian Airlines Sys.	40	33	50	44	45	51	45	46	1.2
15	Swiss International Airlines	-	-	-	-	49	63	51	42	-5.0
	G Total	1,780	2,530	3,983	3,928	4,189	4,170	4,344	4,513	3.5
1	Federal Express Corporation	-	-	502	562	582	602	647	657	4.0
2	United Parcel Service	18	149	378	446	479	452	479	530	4.4
3	Korean Air Lines Co. Ltd.	142	160	247	214	270	280	313	275	6.6
4	China Airlines Ltd.	46	90	182	172	200	208	256	270	11.9
5	Eva Airways Corporation	-	25	117	125	170	179	230	229	16.4
6	Japan Air Lines Co. Ltd.	210	163	183	161	185	185	195	211	6.9
7	Polar Air Cargo Airways	-	75	126	117	169	204	233	188	12.6
8	Singapore Airlines Ltd.	-	34	80	80	112	133	160	179	22.3
9	Northwest Airlines Inc.	124	144	173	158	165	177	192	170	1.8
10	Cathay Pacific Airways Ltd.	-	22	83	80	116	127	154	166	19.9
11	Transportes Aereos Mercantiles	72	97	121	109	102	122	137	133	5.2
12	Asiana Airlines Inc.	-	-	111	93	118	121	119	130	8.7
13	Nippon Cargo Airlines	62	89	106	87	109	115	119	125	9.4
14	Cargolux Airlines Int'l S.A	-	59	85	90	81	79	16	111	5.4
15	Compagnie Nat'l Air France	138	156	159	144	143	97	98	100	-8.6
	L Total	6	18	17	13	12	18	15	25	17.2
1	Omni Air Express	-	-	-	-	0	0	4	11	458.2
2	Air Atlanta Icelandic	-	-	-	-	2	8	2	4	23.6
3	Airtours Int'l Airways	-	2	6	5	3	2	3	2	-15.1
4	Air Atlanta Europe	-	-	-	-	-	-	2	2	29.4
5	United Air Lines Inc.	-	-	-	-	-	0	1	2	566.6
	P Total	356	667	526	529	726	1,039	1,573	1,646	32.8
1	Atlas Air Inc.	-	4	119	138	211	397	416	372	28.1
2	Centurion Cargo Inc.	1	-	-	-	7	61	93	206	211.8
3	Gemini Air Cargo Airways	-	-	15	95	86	66	236	154	12.9
4	Cielos De Peru	-	-	-	-	20	61	140	151	94.8
5	Kalitta Air LLC	-	-	-	6	20	39	99	122	110.3
6	Korean Air Lines Co. Ltd.	2	6	75	77	56	68	92	109	8.9
7	World Airways Inc.	10	1	6	6	35	36	63	101	99.7
8	Southern Air Inc.	-	-	5	44	58	6	56	71	12.9
9	Polar Air Cargo Airways	-	1	17	13	2	9	47	56	43.3
10	Air Atlanta Icelandic	-	-	-	-	0	-	29	55	466.4

Data: BTS website, Accessed: January 2007.

U.S. Trans-Pacific Air Freight Performance

As shown in Table 4, five Asian locations—China, Hong Kong, Japan, South Korea, and Taiwan—increased their air freight performance nearly 1.5 times faster than the average annual growth in the U.S. over the 2001-2005 period. In market-based air freight measurement, their air freight performance grew by 8.6 percent annually, and their share of the U.S. market-based air freight increased to 33.5 percent in 2005, up from 31.1 percent in 2001. Similarly, their segment-based air freight performance recorded a 7.4 percent average annual growth rate over the same time period. Their share of total U.S. segment-based air freight increased from 31.1 percent in 2001 to 33.5 percent in 2005.

China showed the highest average annual growth rate between 2001 and 2005. Its market-based air freight performance grew by 34.7 percent to 421,000 tons in 2005, while its segment-based performance recorded a 36.5 percent average annual growth rate to reach 424,000 tons in 2005. However, its shares of total U.S. air freight only reached about one-half the volumes of Japan and South Korea.

Taiwan, Hong Kong, and South Korea also experienced robust growth over the 2001-2005 period, recording greater than a 10 percent average annual increases. By contrast, Japan recorded a relatively low average annual growth rate of 4.2 percent in market-based measurement, and at 2.3 percent in segment-based air freight measurement.

Table 4: International Air Freight Between U.S. and Major Asian Countries (1000 tons)

Market-based Measurement									
Country	1990	2000	2001	2002	2003	2004	2005	90-00 (%)	01-05 (%)
US Total	3,504	7,017	6,548	6,940	7,163	7,987	8,210	7.2	5.8
5 Asian Countries Total	1,039	2,284	1,964	2,253	2,374	2,741	2,734	8.2	8.6
China	5	104	128	167	200	307	421	35.5	34.7
Hong Kong	106	261	226	302	313	338	358	9.4	12.2
Japan	574	940	769	858	815	913	906	5.1	4.2
South Korea	214	632	554	605	679	817	794	11.4	9.4
Taiwan	145	451	415	488	567	673	676	12.0	13.0
Segment-based Measurement									
Country	1990	2000	2001	2002	2003	2004	2005	01-05 (%)	01-05 (%)
US Total	3,958	7,651	7,164	7,518	7,672	8,607	8,848	6.8	5.4
5 Asian Countries Total	1,180	2,572	2,231	2,524	2,592	2,957	2,960	8.1	7.3
China	4	91	122	162	202	314	424	36.7	36.5
Hong Kong	18	166	192	259	246	277	331	24.9	14.6
Japan	885	1,274	1,013	1,088	1,022	1,133	1,107	3.7	2.2
South Korea	211	668	596	669	751	867	841	12.2	9.0
Taiwan	66	464	430	508	573	680	681	21.5	12.2

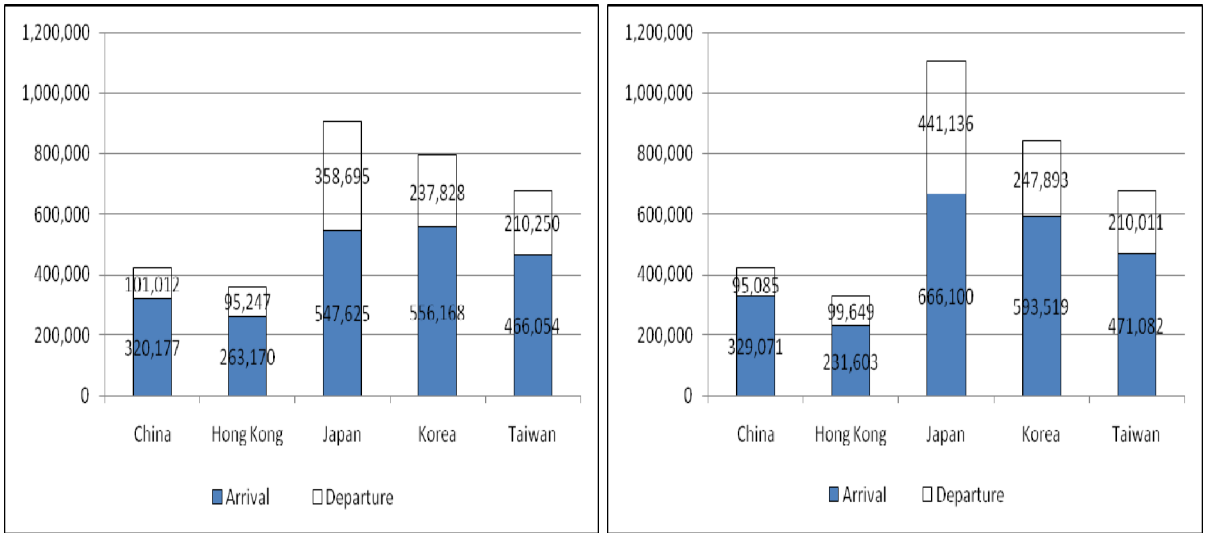
Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: Jan. 2007.

Air freight tonnage arriving in the U.S. from those five Asian locations was much higher than the amount of air freight tonnage departing the U.S. Figure 1 reveals that the U.S. imported about 320,000 tons of air freight from China, but the U.S. exported only about 100,000 tons to China in 2005. Similarly, incoming air freight from Hong Kong, South Korea and Taiwan was greater than

twice the amount of outgoing air freight. Japan's incoming air freight tonnage was 1.5 times larger than outgoing air freight.

Because of China's rapid economic growth, these directional imbalances appear to be widening.

Figure 1: Air Freight Arrival and Departure from/to Asian Countries in 2005 (tons)



Market-based Measurement **Segment-based Measurement**

Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: Jan. 2007.

Overall Air Freight Performance in Texas

There are two outstanding characteristics in air freight performance in Texas. First, market-based air freight tonnage grew much faster than segment-based air freight during both the 1990-2000 and 2001-2005 time periods (see Table 5). In particular, the 11.3-percent market-based growth rate between 2001 and 2005 was 3.6 times greater than the 3.1-percent growth rate for segment-based air freight. The U.S. market- and segment-based air freight growth rates were 5.8 and 5.4 percent, respectively, between 2001 and 2005. Texas recorded a much higher average annual growth rate than the U.S. in market-based air freight performance.

Texas' market-based air freight performance outpaced segment-based air freight tonnage in the early 1990s, and was 1.6 times greater than segment-based air freight tonnage in 2005. Market-based air freight grew to 456,326 tons in 2005, up from 296,939 tons in 2001. By comparison, segment-based air freight performance rose from 249,417 tons in 2001 to 281,331 tons in 2005. This trend may be explained by distance from Texas to Asia and the operational strategy of air carriers to maximize their profits. It should be noted that Texas' air freight performance is exactly opposite to that of Alaska, where segment-based air freight was nearly four times greater than market-based air freight tonnage in 2006.

Secondly, the volume of segment-based outgoing air freight was greater than incoming air freight. Over the 1990-2000 period, arriving segment-based air freight increased by 8.4 percent

annually, and was much higher than the departing segment-based air freight growth rate of 4.8 percent. The share of arriving air freight increased to 51.9 percent in 2000, up from 43.8 percent in 1990, while the share of departing air freight performance decreased from 56.2 percent to 48.1 percent for the same time period.

Over the time period of 2001-2005, however, departing segment-based air freight grew much faster than arriving air freight. Outgoing segment-based air freight performance grew by 6.5 percent to 153,361 tons in 2005, while incoming air freight performance decreased by 0.4 percent to 127,970 tons in 2005. In contrast, U.S. outgoing segment-based air freight tonnage was greater than that of incoming cargo.

The same trend appeared in market-based air freight in terms of both average annual growth rate and tonnage. Arriving air freight volume grew faster than departing volume over the period of 2001-2005. And incoming segment-based volume of 251,853 tons was greater than 204,473 tons of outgoing air freight.

Table 5: International Air Freight Performance of Texas (tons, %)

		1990	1995	2000	2001	2002	2003	2004	2005	90-00	01-05
Mar-ket	Total	129,422 (100.0)	170,389 (100.0)	316,007 (100.0)	296,939 (100.0)	310,119 (100.0)	331,676 (100.0)	413,785 (100.0)	456,326 (100.0)	9.3	11.3
	From	82,917 (64.1)	99,021 (58.1)	148,701 (47.1)	142,849 (48.1)	137,185 (44.2)	147,730 (44.5)	179,667 (43.4)	204,473 (44.8)	6.0	9.4
	To	46,505 (35.9)	71,368 (41.9)	167,306 (52.9)	154,091 (51.9)	172,935 (55.8)	183,947 (55.5)	234,118 (56.6)	251,853 (55.2)	13.7	13.1
Seg-ment	Total	145,269 (100.0)	161,328 (100.0)	273,393 (100.0)	249,417 (100.0)	240,057 (100.0)	256,619 (100.0)	263,840 (100.0)	281,331 (100.0)	6.5	3.1
	From	81,691 (56.2)	92,326 (57.2)	131,497 (48.1)	119,417 (47.9)	117,406 (48.9)	134,981 (52.6)	140,822 (53.4)	153,361 (54.5)	4.9	6.5
	To	63,578 (43.8)	69,002 (42.8)	141,896 (51.9)	130,000 (52.1)	122,651 (51.1)	121,638 (47.4)	123,018 (46.6)	127,970 (45.5)	8.4	-0.4

Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: Jan. 2007.

Major Texas International Air Freight Partner Countries

As shown in Table 6, Texas' market- and segment-based air freight show different results. Taiwan was the largest partner of Texas in 2005 by handling nearly 86,642 tons of air freight, of which 55,517 tons were incoming and 30,125 tons were outgoing. However, there was no non-stop air service between Texas and Taiwan. China, Singapore, and Hong Kong ranked higher in market-based air freight tonnage.

South Korea, the third-largest market-based air freight trading partner, also recorded 1,500 tons in segment-based volume; but, this segment-based air freight performance was far less than market-based air freight of 54,768 tons in 2005. Among Asian countries, only Japan recorded meaningful air freight performance in both market- and segment-based air freight. Nearly 22,000 tons of air freight moved between Japan and Texas in both market and segment-based traffic.

In addition to Asian countries, both European countries—United Kingdom, Germany, the Netherlands, France, Luxembourg, Belgium and Switzerland—and Latin American countries—Mexico, Brazil, Chile, Argentina, and Costa Rica—appeared on the list of top-10 air freight trading partner countries. The United Kingdom placed second in market-based air freight by transporting 61,606 tons; but it placed first in terms of handling 67,704 tons of segment-based air freight. Most of the European countries recorded higher performances on segment-based air freight tonnage.

Mexico recorded the second-largest amount of segment-based air freight (40,479 tons), while its market-based air freight volume was only 25,057 tons. Mexico's imbalance between market- and segment-based air freight was much greater than those of other Latin American countries appearing on the lists of top Texas partner countries.

Table 6: Country Level Air Freight Performance of Texas in 2005 (tons)

Index	Market-based Measurement				Segment-based Measurement			
Country		Total	Arrival	Departure		Total	Arrival	Departure
Total		456,326	251,853	204,473		281,331	127,970	153,361
Taiwan	1	85,642	55,517	30,125	-	-	-	-
United Kingdom	2	61,606	24,520	37,086	1	67,704	23,639	44,064
South Korea	3	54,768	36,123	18,646	15	1,500	1,212	288
Germany	4	38,351	20,500	17,851	5	27,246	12,931	14,315
Netherlands	5	33,245	16,492	16,754	3	35,165	16,747	18,419
France	6	29,405	12,331	17,073	4	31,420	9,394	22,026
Mexico	7	25,057	14,485	10,571	2	40,479	28,102	12,378
China	8	24,546	17,582	6,964	-	-	-	-
Japan	9	21,769	13,875	7,894	6	21,900	13,877	8,023
Brazil	10	11,206	6,127	5,080	8	11,542	6,061	5,481
Singapore	11	10,807	8,957	1,851	-	-	-	-
Luxembourg	12	10,260	88	10,172	11	4,657	88	4,569
Hong Kong-China	13	9,414	8,575	839	-	-	-	-
Belgium	14	7,835	-	7,835	7	13,059	-	13,059
Chile	15	5,865	3,638	2,228	9	5,844	3,628	2,216
Switzerland	16	4,560	1,948	2,612	12	4,531	1,931	2,600
Argentina	17	3,601	2,039	1,562	13	3,477	2,039	1,438
Saudi Arabia	18	3,022	4	3,019	-	-	-	-
Canada	19	2,465	921	1,544	10	5,132	2,373	2,760
Costa Rica	20	1,641	1,498	143	14	1,640	1,499	142
Macau	21	1,641	1,641	-	-	-	-	-
United Arab Emirates	22	1,638	-	1,638	-	-	-	-
Guatemala	23	962	833	129	16	1,021	833	189
El Salvador	24	847	735	112	19	688	624	65
Peru	25	835	781	54	18	838	784	54

Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: Jan. 2007.

The top-10 and top-20 partner locations, as shown in Table 7, respectively accounted for 84.5 and 97.5 percent of total market-based air freight arriving or departing Texas in 2005. These shares were even larger for segment-based air freight performance. The top-10 countries accounted 92.2 percent of total segment-based air freight performance, while the top-20 countries accounted for 99.3 percent. These shares were much higher than those applying to U.S. air freight performance.

For market-based air freight, the top-10 countries consisted of four Asian countries (Taiwan, Korea, China, and Japan), four European countries (United Kingdom, Germany, Netherlands, and France), and two Latin American countries (Mexico and Brazil). On the other hand, five European countries, three Latin American countries, one Asian country (Japan), and one North American country (Canada) were included on the top-10 list for segment-based air freight performance.

Taiwan's market-based air freight performance recorded an average annual growth rate of 22.8 percent, up from 37,689 tons in 2001 to 85,642 tons in 2005. Taiwan outpaced the United Kingdom in 2003 by recording 54,556 tons of market-based air freight, and has maintained its first-place ranking. Other Asian countries also recorded high average annual growth rates. South Korea, the third-largest market-based air freight trading partner, grew by 21.4 percent over the 2001-2005 period to 54,768 tons. China appeared on the top-10 list in 2004, but its air freight performance growth rate of 118.6 percent was more than 10 times greater than the overall market-based air freight performance growth of Texas. Singapore and Hong Kong also recorded high growth rates of 148.2 percent and 93.9 percent, respectively, over the same time period.

Among Asian countries, only Japan recorded a negative average annual growth rate. Japan's market-based air freight performance decreased from 22,860 tons in 2001 to 21,769 tons in 2005. Nevertheless, Japan still remained in 9th place in terms of market-based air freight measurement in 2005.

As for non-Asian countries, Argentina (at a 47.4 percent) and Saudi Arabia (at a 56.3 percent) recorded exceptionally high annual growth rates in market-based performance. However, their shares of total Texas market-based air freight were small. Argentina increased its market-based air freight volume to 3,601 tons, while Saudi Arabia expanded to 3,022 tons. Belgium, Luxembourg, and Costa Rica also recorded above average growth rates, while the United Kingdom, Germany, the Netherlands, France, and Switzerland experienced below average growth rates.

In segment-based air freight measurements, the United Kingdom placed first by handling 67,704 tons in 2005; it was followed by Mexico, Netherlands, France, Germany, Japan, Belgium, Brazil, Chile and Canada. These performances show that Texas non-stop air freight services are oriented to traditional air freight markets such as Europe and Latin America.

Among the top-10 countries, three European countries—United Kingdom, the Netherlands, and Belgium—showed robust growth trends by recording greater than 8-percent growth rates over the 2001-2005 time period. Other top-10 countries recorded below average growth rates or even negative rates over the same time period. Mexico, for example, declined 2.1 percent to 40,479 tons in 2005, while France, increased only by 3.0 percent to 31,420 tons.

Some countries in the top-20 such as Canada, Luxembourg, Argentina, Costa Rica, Guatemala, and Colombia, recorded above average growth rates. Belgium increased its segment-based air freight performance by 33.5 percent to 13,059 tons in 2005; and Canada expanded its volume by 12.8 percent to 5,132 tons. However, their shares of the total Texas segment-based air freight performance were less than 5 percent in 2005.

Table 7: Top-20 Partner Countries of Texas International Air Freights (Tons)

Market-based Measurement									
	1990	1995	2000	2001	2002	2003	2004	2005	01-05 (%)
Total	129,422	170,389	316,007	296,939	310,119	331,676	413,785	456,326	11.3
Top 10	116,883	148,028	289,833	262,919	270,348	286,604	360,021	385,595	10.0
Top 20	122,304	163,778	309,054	290,805	298,625	316,535	403,282	445,066	11.2
Taiwan	6,480	6,006	47,708	37,689	45,063	54,556	80,880	85,642	22.8
United Kingdom	35,049	33,077	49,448	44,709	46,062	48,900	57,790	61,606	8.3
Korea	163	4,337	21,075	25,223	28,429	33,728	55,694	54,768	21.4
Germany	24,488	20,991	31,695	29,123	30,752	31,325	33,793	38,351	7.1
Netherlands	8,174	20,180	22,457	23,575	26,113	27,550	32,647	33,245	9.0
France	12,932	24,514	27,897	30,235	27,158	30,492	28,559	29,405	-0.7
Mexico	20,910	25,430	51,003	37,597	37,982	30,692	27,193	25,057	-9.6
China	-	-	-	-	-	-	11,229	24,546	118.6
Japan	8,687	10,768	29,087	22,860	18,493	19,131	22,015	21,769	-1.2
Brazil	-	2,726	9,462	11,906	10,296	10,230	10,222	11,206	-1.5
Singapore	2,117	1,420	-	285	3,145	4,445	7,753	10,807	148.2
Luxembourg	-	5,219	2,666	5,815	5,948	5,622	1,138	10,260	15.3
Hong Kong-China	1,760	561	74	666	4,081	3,543	7,445	9,414	93.9
Belgium	1	67	1,539	4,111	677	2,462	5,863	7,835	17.5
Chile	0	18	6,997	8,051	5,405	4,611	5,459	5,865	-7.6
Switzerland	70	-	2,888	4,928	4,728	4,633	4,790	4,560	-1.9
Argentina	-	319	1,283	762	92	327	3,375	3,601	47.4
Saudi Arabia	148	239	-	-	2	8	1,933	3,022	56.3
Canada	1,115	3,348	2,768	2,318	2,632	2,928	3,917	2,465	1.5
Costa Rica	210	4,558	1,007	949	1,566	1,352	1,589	1,641	14.7
Segment-based Measurement									
	1990	1995	2000	2001	2002	2003	2004	2005	01-05 (%)
	145,269	161,328	273,393	249,417	240,057	256,619	263,840	281,331	3.1
Top 10	140,974	146,660	251,776	227,309	222,616	231,913	242,164	259,492	3.4
Top 20	141,904	158,220	272,073	247,149	236,359	252,537	261,052	279,374	3.1
United Kingdom	32,559	32,790	51,658	49,482	49,695	52,640	54,810	67,704	8.2
Mexico	51,546	34,760	64,758	44,060	46,265	41,422	36,576	40,479	-2.1
Netherlands	16,194	20,318	22,449	25,722	28,980	31,061	34,744	35,165	8.1
France	13,002	15,917	25,121	27,967	24,705	30,819	31,612	31,420	3.0
Germany	24,126	21,931	37,790	30,651	31,959	31,690	30,964	27,246	-2.9
Japan	1,979	6,060	28,192	21,623	17,429	18,178	21,166	21,900	0.3
Belgium	107	162	1,539	4,111	2,457	4,140	10,326	13,059	33.5
Brazil	94	2,565	10,748	12,742	10,187	9,911	10,063	11,542	-2.4
Chile	-	-	6,366	7,783	5,381	4,595	5,445	5,844	-6.9
Canada	1,367	12,158	3,154	3,169	5,556	7,457	6,458	5,132	12.8
Luxembourg	-	4,165	337	1,242	-	348	-	4,657	39.1
Switzerland	-	-	2,880	4,909	4,678	4,623	4,738	4,531	-2.0
Argentina	-	68	37	12	52	306	3,361	3,477	311.4
Costa Rica	3	4,264	1,001	950	1,565	1,932	1,588	1,640	14.6
South Korea	-	-	8,789	8,793	3,803	8,949	4,850	1,500	-35.7
Guatemala	702	1,035	607	539	782	1,097	1,119	1,021	17.3
Panama Republic	-	800	3,285	1,197	586	728	832	868	-7.7
Peru	-	-	2,086	1,140	1,305	1,418	1,237	838	-7.4
El Salvador	174	755	608	573	629	671	923	688	4.7
Colombia	51	472	667	484	342	552	241	661	8.1

Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: Jan. 2007.

CHAPTER 2. AIR FREIGHT PERFORMANCE WITHIN TEXAS

Nearly 40 Texas airports are involved in handling international air freight. Of those, two dominating airports, Dallas-Ft. Worth (DFW) and Houston (IAH), accounted for 97.0 percent of market-based air freight and 94.7 percent of segment-based air freight in 2005. Austin (AUS), San Antonio (SAT), and El Paso (ELP) shared the remaining portion.

As shown in Table 8, DFW grew its market-based air freight tonnage by an average annual rate of 16.5 percent between 2001 and 2005, up from 159,390 tons to 293,936 tons. DFW's share of total market-based air freight tonnage rose to 64.4 percent in 2005, up from 53.7 percent in 2001. On the other hand, IAH, the second-ranking airport in market-based air freight volume, recorded 148,722 tons in 2005, by growing 8.7 percent annually between 2001 and 2005. Its growth rate was smaller than the average annual air freight growth rate. Therefore, its share of total Texas air freight performance declined from 35.9 percent in 2001 to 32.6 percent in 2005.

In the cases of AUS and SAT, air freight volumes recorded negative growth over the same time period. AUS's air freight performance decreased by 4.2 percent annually, from 8,841 tons in 2001 to 7,106 tons in 2005; and SAT's performance decreased by 14.1 percent annually, from 8,262 tons to 4,492 tons. Thus, their shares of the total market-based Texas air freight were smaller than in previous years.

In segment-based air freight performance, IAH placed first by handling 162,620 tons in 2005. IAH's air freight grew by 9.9 percent annually between 2001 and 2005, and its share of total Texas air freight grew to 57.8 percent in 2005, up from 44.7 percent in 2001. On the other hand, DFW's segment-based air freight decreased by 0.8 percent between 2001 and 2005. Its share of the total Texas air freight decreased to 36.9 percent in 2005, down from 43.0 percent in 2001.

Other airports recorded negative growth between 2001 and 2005 in segment-based air freight. AUS's performance, for example, decreased to 7,000 tons in 2005 as a result of an average annual decline of 2.2 percent between 2001 and 2005. SAT experienced an even more rapid decrease, a 14.0-percent average annual decline, over the same time period. Its segment-based air freight declined from 8,293 tons in 2001 to 4,526 tons in 2005.

Table 8: International Air Freight Performance of Texas' Airports (Tons)

Market-based Measurement									
Airport	1990	1995	2000	2001	2002	2003	2004	2005	01-05 (%)
Total	129,422	170,389	316,007	296,939	310,119	331,676	413,785	456,326	11.3
Dallas-Ft. Worth (DFW)	63,323	69,249	167,217	159,390	163,168	182,712	261,847	293,936	16.5
Houston (IAH)	60,998	85,394	107,563	106,548	112,640	129,611	135,104	148,722	8.7
Austin (AUS)	83	3	5,862	8,441	9,971	10,922	8,386	7,106	-4.2
San Antonio (SAT)	3,074	4,113	9,616	8,262	7,673	4,358	4,109	4,492	-14.1
El Paso (ELP)	127	4,145	5,014	3,462	3,089	3,438	3,803	857	-29.5
Houston (EFD[a])	935	4,734	11,938	9,700	10,233	-	-	363	-
El Paso (BIF[b])	12	-	80	-	1,319	20	19	237	-
Laredo (LRD)	8	1,247	8,430	898	1,473	160	302	216	-30.0
Killeen (GRK)	-	-	2	2	1	59	-	133	-
Fort Worth (AFW)	-	3	64	-	16	-	-	98	-
Segment-based Measurement									
Airport	1990	1995	2000	2001	2002	2003	2004	2005	01-05 (%)
Total	145,269	161,328	273,393	249,417	240,057	256,619	263,840	281,331	3.1
Houston (IAH)	74,525	82,333	109,907	111,391	117,044	141,350	141,371	162,620	9.9
Dallas-Ft. Worth (DFW)	62,621	63,047	121,118	107,217	88,464	95,227	105,205	103,926	-0.8
Austin (AUS)	61	4	5,203	7,812	9,770	11,063	7,282	7,148	-2.2
San Antonio (SAT)	3,081	3,907	9,638	8,293	7,705	4,451	4,280	4,526	-14.0
El Paso (ELP)	127	4,107	6,162	3,594	3,379	3,520	3,828	1,223	-23.6
Laredo (LRD)	8	1,654	9,090	1,212	2,311	429	1,292	1,155	-1.2
Houston (EFD[a])	973	4,708	11,953	9,700	10,233	2	9	365	-56.0
Dallas (DAL)	-	28	-	-	27	134	182	95	-
Fort Worth (AFW)	-	17	87	0	123	59	7	88	-
El Paso (BIF[b])	-	-	-	-	632	20	19	70	-

Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: Jan. 2007.

Note: a: Houston Ellington Field Airport, b: El Paso Biggs Aaf Airport.

Overall Air Freight Performance by Service Type

As shown in Table 9, scheduled all cargo air service transported the largest amount of market-based air freight in 2005, followed by scheduled passenger/cargo combination service. Scheduled all cargo operations outpaced passenger/cargo combination service in 2005 by handling 203,572 tons. Scheduled all cargo performance grew by 18.4 percent annually between 2001 and 2005. As a result, its share of total Texas market-based air freight performance grew from 34.9 percent in 2001 to 44.6 percent in 2005.

Scheduled passenger/cargo combination performance reached to 188,124 tons in 2005 by recording a relatively low average annual growth rate of 2.5 percent over the 2001-2005 period. Its share of the total Texas market-based air freight tonnage decreased from 57.4 percent in 2001 to 41.2 percent in 2005.

It should be noted that non-scheduled all cargo market-based air freight grew rapidly in recent years. Its performance recorded an average annual growth rate of 29.7 percent. As a result, its share in the total Texas market-based air freight performance grew to 14.1 percent in 2005, nearly doubling from 7.6 percent in 2001.

In terms of segment-based air freight, scheduled passenger/cargo has maintained first place. Even so, its segment-based air freight performance growth rate of 1.8 percent between 2001 and 2005 was less than the average growth rate of 3.1 percent. Its volume increased by 1.8 percent annually, from 170,175 tons in 2001 to 182,923 tons in 2005. As a result, its share of the total Texas segment-based air freight performance fell to 65.0 percent in 2005, down from 68.2 percent in 2001.

All cargo service expanded from 60,288 tons in 2001 to 86,739 tons in 2005. Its segment-based air freight grew by 9.5 percent, over three times faster than the average growth rate; consequently, its share of the total Texas segment-based air freight performance increased from 24.2 percent in 2001 to 30.8 percent in 2005.

Non-scheduled all cargo service showed variation over the same time period. Its segment-based performance reached to the highest point, 24,427 tons in 2003, and then it fell rapidly to 11,445 tons in 2005.

Table 9: Texas International Air Freight Performance Trends by Service Type (tons)

Market-based Performance									
Type	1990	1995	2000	2001	2002	2003	2004	2005	01-05 (%)
Total	129,422	170,389	316,007	296,939	310,119	331,676	413,785	456,326	11.3
F	101,573	113,989	176,954	170,584	160,633	164,865	182,587	188,124	2.5
G	23,964	45,943	114,084	103,574	127,924	137,634	168,205	203,572	18.4
L	16	8	10	103	1,508	131	-	364	37.0
P	3,868	10,449	24,959	22,678	20,054	29,046	62,993	64,266	29.7
Segment-based Performance									
Type	1990	1995	2000	2001	2002	2003	2004	2005	01-05 (%)
Total	145,269	161,328	273,393	249,417	240,057	256,619	263,840	281,331	3.1
F	130,612	110,239	176,775	170,175	156,620	159,783	177,743	182,923	1.8
G	10,245	41,578	70,751	60,288	67,023	72,026	65,665	86,739	9.5
L	16	8	10	52	1,508	383	178	224	44.4
P	4,396	9,503	25,857	18,903	14,906	24,427	20,255	11,445	-11.8

Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: Jan. 2007.

As shown in Table 10, U.S. and European air carriers ranked highest in terms of passenger/cargo combination services. American Airlines placed first, followed by Continental Airlines, British Airways, KLM Royal Dutch Airlines, and Lufthansa German Airlines.

American Airlines carried nearly 67,000 tons of market-based air freight, and second-place Continental Airlines carried 48 thousand tons. These two U.S. air carriers recorded 3.8-percent average annual growth over the 2001-2005 period. British Airways recorded 10.0 percent, a rate four times higher than the average combination service's growth over the same time period. Its market-based air freight performance grew to 25,000 tons in 2005. Lufthansa also recorded relatively high growth.

In market-based air freight, Korean Airlines and Taca International Airlines passenger/cargo combination aircraft operators showed a relatively high growth rate over the period of 2001 to 2005. However, their shares in the total Texas market-based air freight performance were small. Other air carriers such as China Airlines and Pakistan International Airlines appeared in the market in 2004; but, they grew much faster than other combination carriers. China Airlines grew by 191.3 percent, up from 263 tons to 765 tons in 2005.

Compared to passenger/cargo combination services, different air carriers were involved in all cargo air service. In market-based measurements, EVA Airways ranked first by carrying out 51,000 tons of freight in 2005, followed by China Airlines (34,000 tons), Singapore Airlines (30,000 tons), Korean Airlines (17,000 tons), United Parcel Service (16,000 tons), and China Cargo Airline (12,000 tons).

Passenger/cargo combination service providers, such as EVA Airways, Singapore Airlines, China Cargo Airline, and Global Supply System, recorded far higher average growth rates. EVA Airways, the leading all cargo service provider, increased its volume of freight by 33.9 percent, and Singapore Airlines grew by 151.7 percent, more than eight times faster than the average growth rate. Global Supply System also experienced rapid growth, although it has a short history in the all cargo service market.

Non-scheduled all cargo service showed two characteristics. First, its performance grew rapidly since 2003, but there were significant losers in the market. Some non-scheduled all cargo carriers such as Southern Air, Air Atlanta Icelandic, and Astar Air Cargo experienced rapid growth during last two years. Meanwhile, other non-scheduled air carriers such as Volga-Dnepr Airline, Custom Air Transport, and Polar Air Cargo Airways experienced declining growth.

Secondly, non-scheduled all cargo service providers have relatively short histories, and their performance each year showed large variations. For example, Southern Air appeared in the market in 2002 carrying only 1,000 tons of market-based air freight; but, it became the largest non-scheduled all cargo carrier in market-based air freight measurement by transporting 29,000 tons in 2005. Korean Airlines' historical performance also showed large variations, ranging from 9,000 tons to 29,000 tons.

Table 10: Air Carrier Level Market-based Air Freight Performance Trends (tons)

CARRIER_NAME	1990	1995	2000	2001	2002	2003	2004	2005	01-05 (%)
Texas Total	129,422	170,389	316,007	296,939	310,119	331,676	413,785	456,326	11.3
F Total	101,573	113,989	176,954	170,584	160,633	164,865	182,587	188,124	2.5
American Airlines Inc.	25,710	33,103	60,105	57,437	54,876	54,176	64,299	66,716	3.8
Continental Air Lines Inc.	14,981	19,453	42,909	41,041	43,148	46,306	47,503	47,870	3.9
British Airways Plc	19,128	16,842	17,978	17,391	20,146	20,357	23,743	25,441	10.0
Klm Royal Dutch Airlines	8,091	20,180	21,583	22,465	20,852	21,428	22,633	22,866	0.4
Lufthansa German Airlines	19,390	11,147	14,888	11,846	13,210	14,016	14,529	14,764	5.7
Compagnie Nat'l Air France	4,635	3,131	7,762	10,061	5,718	6,151	6,507	6,978	-8.7
Korean Air Lines Co. Ltd.	-	4,253	1,408	676	1,064	1,110	1,236	1,274	17.2
China Airlines Ltd.	-	-	-	-	-	-	263	765	191.3
Pakistan Int'l Airlines	-	-	-	-	-	-	433	540	24.7
Aeromexico	-	777	1,095	708	522	414	578	375	-14.7
Taca Int'l Airlines	66	253	78	77	87	222	353	323	43.1
Air Canada	-	934	466	796	640	517	351	114	-38.5
G Total	23,964	45,943	114,084	103,574	127,924	137,634	168,205	203,572	18.4
Eva Airways Corporation	-	-	14,828	15,972	26,284	32,523	49,642	51,296	33.9
China Airlines Ltd.	2,030	5,335	32,067	21,283	18,779	22,032	30,958	33,581	12.1
Singapore Airlines Ltd.	-	-	8	740	7,392	11,448	20,851	29,706	151.7
Korean Air Lines Co. Ltd.	-	-	14,013	12,266	19,292	23,284	13,497	17,123	8.7
United Parcel Service	197	8,168	23,778	21,237	22,416	14,641	15,722	15,900	-7.0
China Cargo Airline	-	-	-	-	-	-	6,168	12,139	96.8
Cargolux Airlines Int'l S.A	-	6,264	4,153	7,480	8,012	8,106	1,698	11,295	10.9
Compagnie Nat'l Air France	1,677	10,240	6,798	6,211	5,868	9,179	8,180	9,110	10.1
Lufthansa German Airlines	290	4,167	13,772	13,178	12,048	10,354	5,533	7,104	-14.3
Global Supply System	-	-	-	-	-	1,009	6,213	6,227	148.4
Martinair Holland N.V.	-	-	896	1,081	2,631	2,477	4,762	4,802	45.2
Saudi Arabian Airlines Corp	-	-	-	-	-	-	1,863	3,022	62.3
L Total	16	8	10	103	1,508	131	-	364	37.0
Omni Air Express	-	-	-	-	-	-	-	363	
Compania Mexicana De Aviaci	16	-	-	-	-	-	-	1	
P Total	3,868	10,449	24,959	22,678	20,054	29,046	62,993	64,266	29.7
Southern Air Inc.	-	-	-	-	1,340	101	16,881	29,172	179.2
Korean Air Lines Co. Ltd.	42	-	5,504	11,190	5,129	9,258	28,927	19,231	55.4
Air Atlanta Icelandic	-	-	-	-	-	-	3,482	6,194	77.9
Atlas Air Inc.	-	829	87	539	591	790	1,405	3,243	56.6
Volga-Dnepr Airlines	-	-	-	-	2,019	4,556	1,405	1,794	-3.9
Astar Air Cargo Inc.	-	14	-	-	14	91	1,329	1,450	374.4
Custom Air Transport	-	-	-	-	-	4,529	2,352	776	-58.6
Polyot Airlines	-	-	-	70	103	317	490	375	52.3
Polar Air Cargo Airways	-	176	-	-	-	-	636	297	-53.3
Centurion Cargo Inc.	-	-	-	-	-	-	123	263	113.8
USA Jet Airlines Inc.	-	72	280	175	528	310	336	253	9.6
Evergreen Int'l Inc.	23	260	159	-	554	90	89	194	-29.5
Gemini Air Cargo Airways	-	-	98	20	56	5	-	186	74.9
Kalitta Air LLC	-	-	-	203	766	448	2,068	150	-7.4
Ameristar Air Cargo	-	-	63	90	118	84	220	128	9.0

Source: BTS website, Accessed: January 2007.

In segment-based air freight, both scheduled and non-scheduled services, as shown in Table 11, were primarily conducted by U.S. and European air carriers. Scheduled passenger/cargo combination service included similar air carriers with market-based air freight measurements. American Airlines was the largest air freight carrier among passenger/cargo combination service providers, followed by Continental Airlines, British Airways, KLM Royal Dutch Airlines, and Lufthansa. These same air carriers recorded similar market-based air freight performances.

Cargolux Airlines International transported the largest amount of segment-based air freight among scheduled all cargo carriers, followed by Compagnie National Air France, UPS, Singapore Airlines, and Martinair Holland N.V. Cargolux Airlines International's performance grew by 26.9 percent to 21,000 tons in 2005, while Compagnie National Air France's performance increased by 28.6 percent to 19,000 tons in 2005.

UPS and Lufthansa recorded negative growth rates of -7.0 percent and -30.9 percent. Consequently, their performance decreased to 16,000 tons and to 4,000 tons in 2005. In segment-based air freight performance, Singapore Airlines was the only Asian carrier which provided scheduled all cargo service. Its performance rose to 11,000 tons in 2005 by growing 71.1 percent annually between 2002 and 2005.

Non-scheduled all cargo service fell down by 11.8 percent over the 2001-2005 period, mainly because of a rapid decline in 2005. Custom Air Transport, Ameristar Air Cargo, Korean Air Lines, Kalitta Air, and Polar Air Cargo Airways experienced sharp decreases in 2005. Custom Air Transport's segment-based air freight performance decreased by 67.1 percent in 2005, down from 2,362 tons in 2004 to 776 tons in 2005. Korean Air Lines showed a more rapid decrease, nearly 86 percent to 565 tons in 2005. Kalitta Air's air freight performance also declined sharply from 832 tons in 2004 to 405 tons in 2005, although its air freight performance had grown steadily by 2004. Some other non-scheduled all cargo air carriers such as Atlas Air, Astar Air Cargo, USA Jet Airlines and Centurion cargo recorded significantly high average growth rates. Atlas Air, for example, grew by 56.6 percent over the period of 2001-2005. Its segment-based air freight performance increased from 539 tons in 2001 to 3,243 tons in 2005. Similarly, USA Jet Airlines expanded its air freight performance from 298 tons in 2001 to 986 tons in 2005, or the equivalent of a 34.9 percent average growth rate.

This shows that non-scheduled all cargo services have potential to grow fast, but they also have a weak foundation. Non-scheduled air carrier segment-based air freight performances are shown in Table 11.

Table 11: Air Carrier Level Segment-based Air Freight Performance Trends (tons)

CARRIER_NAME	1990	1995	2000	2001	2002	2003	2004	2005	01-05 (%)
Texas Total	145,269	161,328	273,393	249,417	240,057	256,619	263,840	281,331	3.1
F Total	130,612	110,239	176,775	170,175	156,620	159,783	177,743	182,923	1.8
American Airlines Inc.	22,914	32,728	59,618	57,007	54,517	54,079	64,096	66,568	4.0
Continental Air Lines Inc.	13,975	19,347	42,816	40,953	43,164	46,245	47,416	47,908	4.0
Klm Royal Dutch Airlines	24,153	20,180	21,583	22,426	20,852	21,402	22,633	22,866	0.5
British Airways Plc	18,682	16,790	17,969	17,374	16,344	15,490	19,493	21,043	4.9
Lufthansa German Airlines	26,906	11,135	15,032	11,846	13,201	13,997	14,483	14,764	5.7
Compagnie Nat'l Air France	15,758	4,282	7,756	10,061	5,718	6,143	6,498	6,965	-8.8
Korean Air Lines Co. Ltd.	-	-	1,828	949	1,208	1,110	1,236	1,274	7.6
Pakistan Int'l Airlines	-	-	-	-	-	-	433	540	24.7
Aeromexico	-	777	1,095	708	522	415	578	375	-14.7
Taca Int'l Airlines	136	253	78	77	87	222	353	323	43.1
G Total	10,245	41,578	70,751	60,288	67,023	72,026	65,665	86,739	9.5
Cargolux Airlines Int'l S.A	-	5,070	4,161	7,917	11,388	14,135	2,879	20,528	26.9
Compagnie Nat'l Air France	6,084	12,576	6,279	6,958	7,740	16,205	18,540	19,036	28.6
United Parcel Service	336	8,142	23,778	21,237	22,416	14,641	15,722	15,900	-7.0
Singapore Airlines Ltd.	-	-	8	-	2,134	4,080	8,324	10,680	71.1
Martinair Holland N.V.	-	-	867	4,027	5,678	6,620	7,637	9,177	22.9
Global Supply System	-	-	-	-	-	1,359	3,921	4,268	77.2
Lufthansa German Airlines	538	5,368	28,673	16,757	13,226	11,046	4,366	3,819	-30.9
Saudi Arabian Airlines Corp	-	-	-	-	-	-	1,643	2,379	44.8
Varig S. A.	-	-	-	-	-	-	237	576	142.7
Federal Express Corporation	-	-	129	-	122	47	50	145	5.8
L Total	16	8	10	52	1,508	383	178	224	44.4
Omni Air Express	-	-	-	-	-	-	178	223	25.6
Compania Mexicana De Aviaci	16	-	-	-	-	-	-	1	
P Total	4,396	9,503	25,857	18,903	14,906	24,427	20,255	11,445	-11.8
Atlas Air Inc.	-	-	87	539	985	641	1,405	3,243	56.6
Volga-Dnepr Airlines	-	-	-	-	1,365	4,604	955	1,563	4.6
Astar Air Cargo Inc.	-	14	-	-	14	91	1,329	1,450	374.4
USA Jet Airlines Inc.	-	182	844	298	717	436	784	986	34.9
Custom Air Transport	-	-	-	-	-	4,394	2,362	776	-58.0
Ameristar Air Cargo	-	-	192	401	848	471	1,019	604	10.8
Korean Air Lines Co. Ltd.	42	-	4,899	6,897	2,149	6,217	3,992	565	-46.5
Kalitta Air LLC	-	-	-	203	319	571	832	405	18.8
Polar Air Cargo Airways	-	176	-	-	-	-	636	297	-53.3
Centurion Cargo Inc.	-	-	-	-	-	-	152	263	72.9

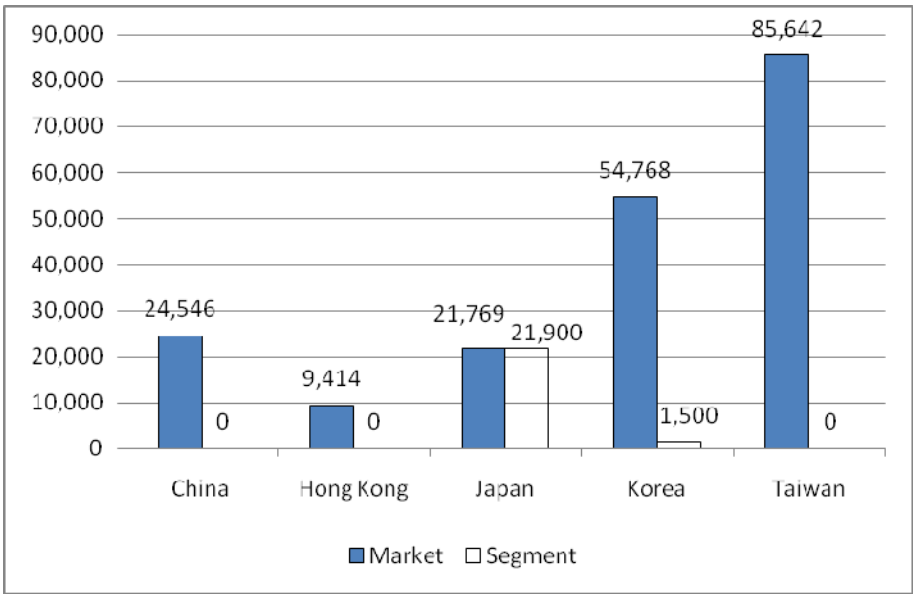
Source: BTS website, Accessed: January 2007.

Trans-Pacific Air Freight of Texas

As shown in Figure 2, Japan was involved in both market- and segment-based transportation. South Korea recorded a small amount of segment-based air freight. And China, Hong Kong, and Taiwan showed none.

As for market-based air freight traffic, Taiwan transported 85,642 tons and Korea 54,768 tons in 2005. Both China and Japan also recorded more than 20,000 tons. These figures show that Texas is a preferred origin or final destination of air freight from/to major Asian countries.

Figure 2: Trans-Pacific Air Freight Performance of Texas in 2005 (tons)



Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: Jan. 2007.

In market-based air freight performance, those Asian countries recorded 24.3 percent average growth rate in volume of transported freight between 2001 and 2005. This average growth rate was more than twice that of Texas over the same time period. China, Hong Kong, Singapore, South Korea, and Taiwan, as shown in Table 12, recorded much higher average annual growth rates at 118.6 percent, 32.1 percent, 50.9 percent, 21.4 percent, and 22.8 percent, respectively. In particular, incoming air freight grew much faster than outgoing air freight between 2001 and 2005. These directional imbalances between air freight arrivals and departures have increased over years. Japan recorded a positive growth rate of 1.1 percent, while outgoing air freight to Japan decreased rapidly at 4.7 percent.

Table 12: Trans-Pacific Air Freight Performance of Texas: Market-based Measurement (Tons)

	Country	1990	2000	2001	2002	2003	2004	2005	01-05 (%)
TOTAL	Texas Total	129,422	316,007	296,939	310,119	331,676	413,785	456,326	11.3
	Six Countries Total	19,207	97,945	86,724	99,212	115,402	185,016	206,946	24.3
	China	-	-	-	-	-	11,229	24,546	118.6[1]
	Hong Kong	1,760	74	666	4,081	3,543	7,445	9,414	32.1[2]
	Japan	8,687	29,087	22,860	18,493	19,131	22,015	21,769	-1.2
	Singapore	2,117	-	285	3,145	4,445	7,753	10,807	50.9[2]
	South Korea	163	21,075	25,223	28,429	33,728	55,694	54,768	21.4
	Taiwan	6,480	47,708	37,689	45,063	54,556	80,880	85,642	22.8
DEPARTURE	Texas Total	82,917	148,701	142,849	137,185	147,730	179,667	204,473	9.4
	Six Countries Total	12,140	40,855	38,280	35,425	35,095	59,376	66,318	14.7
	China	-	-	-	-	-	4,110	6,964	69.4[1]
	Hong Kong	125	74	174	166	59	398	839	48.1
	Japan	5,580	11,509	9,560	6,870	7,104	8,034	7,894	-4.7
	Singapore	2,117	-	20	1,137	1,127	2,142	1,851	17.6[2]
	South Korea	161	9,624	9,177	8,603	9,160	15,434	18,646	19.4
	Taiwan	4,157	19,648	19,349	18,648	17,645	29,258	30,125	11.7
ARRIVAL	Texas Total	46,505	167,306	154,091	172,935	183,947	234,118	251,853	13.1
	Six Countries Total	7,068	57,090	48,444	63,787	80,307	125,640	140,628	30.5
	China	-	-	-	-	-	7,119	17,582	147.0[1]
	Hong Kong	1,636	-	492	3,915	3,484	7,047	8,575	29.9[2]
	Japan	3,107	17,579	13,300	11,622	12,026	13,982	13,875	1.1
	Singapore	-	-	265	2,009	3,318	5,611	8,957	64.6
	South Korea	1	11,451	16,047	19,826	24,567	40,260	36,123	22.5
	Taiwan	2,323	28,060	18,340	26,415	36,911	51,622	55,517	31.9

Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: Jan. 2007.

Note: 1: Growth between 2004 and 2005.
2: Average growth between 2002 and 2005.

Air Cargo Performance of Dallas-Fort Worth International Airport (DFW)

As shown in Table 13, total air cargo volumes, including both domestic and international air cargo, decreased by 3.1 percent over the 2001-2006 period mainly because of a rapid decline in domestic performance. In 2001, domestic air cargo recorded its highest volume of 818,555 tons, but it decreased to 524,637 tons in 2006. As a result, its share of total air freight decreased from 83.8 percent in 2001 to 62.9 percent in 2006.

At the same time, international air cargo performance increased sharply, showing an average annual growth rate of 14.4 percent. Freight handled grew to 310,006 tons in 2006, up from 157,889 tons in 2001. As a consequence, its share grew to 37.1 percent in 2006, up from 16.2 percent in 2001. This shows that DFW is becoming an international air cargo oriented airport.

Table 13: Air Cargo Trends of DFW Airport (tons)

Year	2001	2002	2003	2004	2005	2006	01-06 (%)
Total	976,444	916,810	736,046	817,825	817,866	834,643	-3.1
Domestic	818,555	739,041	524,390	549,222	543,237	524,637	-8.5
International	157,889	177,769	211,656	268,603	274,629	310,006	14.4
Share of International (%)	16.2	19.4	28.8	32.8	33.6	37.1	-

Source: DFW Airport website, Available: http://www.dfwairport.com/stats/, Accessed: July 2007.

DFW's air freight performance, as shown in Table 14, grew to 314,223 tons in 2006 in market-based volume by recording 14.5-percent average annual growth rate since 2001. Its segment-based performance recorded relatively low growth rate of 0.6 percent over the same time period. Hence, DFW is preferred as an origin or final destination of air freight, rather than an intermediate airport for international air freight flights. DFW especially seems to be a preferred gateway for incoming air freight. Its incoming market-based air freight performance of 188,810 tons was much larger than its outgoing air freight performance at 125,414 tons in 2006.

Scheduled all cargo service grew the most 60.4 percent by recording 189,756 tons in 2006, followed by scheduled passenger/cargo combination flight service at 26.1 percent, and non-scheduled all cargo flight service at 13.5 percent. On the other hand, scheduled passenger/cargo combination flights were first in segment-base traffic, accounting for 74.1 percent of the total, followed by scheduled all-cargo service at 24.7 percent.

In market-based measurements, outgoing air freight grew annually by 11.0 percent, up from 71,928 tons in 2001 to 125,414 tons in 2006. Incoming air freight increased by 16.6 percent annually, and reached to 188,810 tons in 2006, up from 87,462 tons in 2001. As a result, the share of DFW's departing air freight performance decreased from 45.1 percent in 2001 to 39.9 percent in 2006. Its share of arriving air freight grew to 60.1 percent in 2006, up from 54.9 percent in 2001. Hence, a significant imbalance exists between DFW's arrival and departure air freight performance.

All cargo services, regardless of whether they are scheduled or non-scheduled, grew much faster than passenger/cargo combination flight services in market-based performance. Scheduled all cargo service grew by 23.7 percent annually between 2001 and 2006, up from 65,419 tons in 2001 to 189,756 tons in 2006. Non-scheduled all-cargo service recorded an even higher average annual growth rate of 40.1 percent between 2001 and 2006, although its performance decreased by 23.4 percent in 2006. As a result, non-scheduled all cargo service has potential to grow quickly, but it also has a higher risk than scheduled service. Similar trends apply to both departure and arrival of air freight.

In segment-based air freight performance, outgoing air freight volume grew from 46,055 tons in 2001 to 60,744 tons in 2006 at a 5.7 percent average annual growth rate between 2001 and 2006. Incoming air freight volume decreased by 4.0 percent annually over the same time period. Incoming air freight recorded the lowest performance at 45,131 tons in 2003, and then it expanded to nearly 49,881 tons in 2006. However, this level of traffic is still lower than its peak

volume of 65,002 tons in 2000. The share of outgoing air freight grew to 51.9 percent in 2006, up from 43.0 percent in 2001. Incoming air freight accounted for 48.1 percent of total segment-based air freight in 2006, down from 57.0 percent in 2001.

Departing segment-based air freight performed by scheduled passenger/cargo combination flight service recorded 2.9 percent annual growth rate, and scheduled all cargo flight service increased by 15.0 percent annually between 2001 and 2006. Outgoing air freight handled by non-scheduled services recorded negative growth over the same time period. In terms of arriving air freight, both scheduled combination service and non-scheduled all-cargo service recorded negative growth, while scheduled all cargo service showed 0.1 percent average annual growth between 2001 and 2006. Scheduled all cargo service recorded the lowest performance in 2003, and it grew rapidly between 2003 and 2006.

Table 14: International Air Freight Trends of DFW by Service Type (tons)

Market-based Measurement										
Port	Class	1990	2000	2001	2002	2003	2004	2005	2006	01-06 (%)
Total	Total	63,323	167,217	159,390	163,168	182,712	261,847	293,936	314,223	14.5
	F	51,678	85,510	82,653	70,230	70,036	81,577	83,512	82,062	-0.1
	G	11,087	75,777	65,419	85,267	100,749	129,023	154,936	189,756	23.7
	L	16	9	-	-	47	-	188	53	-
	P	541	5,921	11,318	7,672	11,880	51,247	55,300	42,353	30.2
Depar-ture	Total	37,926	75,202	71,928	65,541	70,655	103,831	117,255	125,414	11.8
	F	31,172	37,064	35,859	29,041	31,018	38,327	41,753	40,742	2.6
	G	6,223	35,577	33,082	35,172	36,141	48,559	54,232	68,537	15.7
	L	16	9	-	-	15	-	87	32	-
	P	516	2,552	2,986	1,327	3,482	16,945	21,183	16,102	40.1
Arrival	Total	25,397	92,016	87,462	97,628	112,057	158,016	176,681	188,810	16.6
	F	20,507	48,446	46,793	41,189	39,018	43,249	41,758	41,320	-2.5
	G	4,865	40,200	32,337	50,095	64,609	80,464	100,705	121,219	30.2
	L	-	-	-	-	32	-	101	21	-
	P	25	3,370	8,332	6,345	8,398	34,303	34,117	26,250	25.8
Segment-based Measurement										
Port	Class	1990	2000	2001	2002	2003	2004	2005	2006	01-06 (%)
Total	Total	62,621	121,118	107,217	88,464	95,227	105,205	103,926	110,625	0.6
	F	61,521	85,438	82,449	70,052	69,992	81,389	83,382	81,995	-0.1
	G	546	30,629	17,712	15,791	17,399	14,376	18,814	27,274	9.0
	L	16	9	-	-	296	178	224	65	-
	P	538	5,042	7,056	2,622	7,540	9,262	1,505	1,291	-28.8
Depar-ture	Total	36,616	56,117	46,055	43,124	50,095	59,300	57,853	60,744	5.7
	F	36,045	36,620	35,356	28,739	30,984	38,268	41,663	40,696	2.9
	G	39	17,574	9,407	13,778	16,749	13,255	14,822	18,934	15.0
	L	16	9	-	-	15	-	105	44	-
	P	515	1,913	1,291	607	2,347	7,777	1,263	1,070	-3.7
Arrival	Total	26,005	65,002	61,163	45,340	45,131	45,904	46,073	49,881	-4.0
	F	25,476	48,817	47,093	41,313	39,008	43,120	41,719	41,299	-2.6
	G	507	13,055	8,305	2,012	650	1,121	3,993	8,341	0.1
	L	-	-	-	-	281	178	119	21	-
	P	23	3,129	5,765	2,015	5,192	1,486	242	220	-47.9

Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: Jan. 2007.

The top-10 airports for market-based air freight consisted of seven Asian airports. They are Taipei (TPE), Seoul (ICN), Shanghai (PVG), Hong-Kong (HKG), Tokyo (NRT), Singapore (SIN), and Beijing (PEK). Three were European airports—Frankfurt (FRA), London (LGW), and Paris (CDG). In all, the seven Asian airports accounted for 70.3 percent of DFW's market-based air freight performance in 2006. This shows that DFW relies heavily on Asia for its market-based air freight performance. The top-10 airports for segment-based air freight included five European airports, including Brussels (BRU) and Zurich (ZRH), three Latin American airports, consisting of Sao Paulo (GRU), Santiago (SCL), and Buenos Aires (EZE), and two Asian airports, Tokyo (NRT) and Osaka (KIX). These top-10 airports accounted for nearly 92 percent of DFW's total segment-based air freight performance in 2006. Five European airports accounted for 63.8 percent of DFW's segment-based air freight performance in 2006. Therefore, DFW depends more heavily on the European region for its segment-based air freight.

These data reveal that there is significant demand for air freight between DFW and Asian airports, but few direct flight services are provided. This can be attributed the long travel distances between DFW and Asian airports. European airports have the advantage of being located within the ranges non-stop flights from/to DFW, whereas aircraft are not able to fly directly between DFW and Asian airports without stopping; they load as much as freight possible in order to maximize their revenue from every flight.

In market-based air freight performance, TPE recorded the largest amount of air freight tonnage in 2006. Its market-based air freight volume grew to 86,350 tons in 2006, experiencing an 18.3 average annual growth rate over the 2001-2006 period. ICN, the second-largest air freight partner airport, increased its volume by 17.7 percent annually to 56,538 tons in 2006. Similarly, other Asian airports also recorded much higher average annual growth rates, compared to those of other partner airports appearing on the top-20 list. SIN's performance increased by 116.3 percent annually, and the three Chinese airports of PVG, HKG, and PEK recorded high average annual growth rates of 59.6 percent, 116.3 percent and 106.7 percent, respectively.

In comparison to Asian airports, European airports recorded much lower average annual growth rates over the same time period. FRA, the third-largest market-based air freight handling airport, recorded an average annual growth rate of 7.5 percent, and its performance resulted in 26,877 tons in 2006. LGW recorded a 3.6 percent average annual growth rate and CDG recorded negative growth rate at -2.2 percent over the same time period. LGW's air freight performance reached a peak of 23,825 tons in 2005, but it decreased to 21,920 tons in 2006. CDG's performance increased by 32.0 percent in 2006, to 7,852 tons, after its performance declined to the lowest level of 5,950 tons in 2005.

In terms of segment-based air freight measurements, European airports recorded relatively high average growth. Between 2001 and 2006, FRA's air freight volume recorded an average annual growth rate of 5.7 percent and LGW's increased by 3.7 percent. FRA recorded the lowest volume of 17,930 tons in 2005, but its performance recovered to 26,829 tons in 2006. LGW's performance reached to its highest level at 23,745 tons in 2005, and then decreased to 21,966 tons in 2006. BRU showed the highest average annual growth rate of 16.9 percent among European airports. Its segment-based air freight performance increased from 4,110 tons in 2001

to 8,956 tons in 2006. However, the other major airports, such as CDG and ZRH, recorded negative growth over the same time period.

Latin American airports showed mostly negative growth; for example, GRU declined -9.9 percent, SCL -8.2 percent and MEX -1.3 percent, over the time period of 2001-2006. NRT showed robust segment-based air freight performance along with high average annual growth rate. NRT's performance grew to nearly 12,792 tons, with a 6.0 percent average annual growth rate between 2001 and 2006.

Table 15: Top-20 Partner Airports of DFW (tons)

Market-based Measurement									
Airport	1990	2000	2001	2002	2003	2004	2005	2006	01-06 (%)
Total	63,323	188,194	163,764	163,168	182,712	261,847	293,936	314,223	13.9
Top 10	44,934	132,054	119,548	139,682	156,212	229,825	254,162	277,717	18.4
Taipei (TPE)	6,480	47,087	37,255	45,063	54,555	80,617	84,877	86,350	18.3
Seoul (ICN)	-	20,977	24,995	27,309	33,653	55,594	54,582	56,538	17.7
Frankfurt (FRA)	15,187	23,562	18,743	21,926	22,171	23,897	26,719	26,877	7.5
Shanghai (PVG)	-	-	-	-	-	9,651	22,847	24,586	59.6
Hong Kong (HKG)	1,760	74	666	3,894	3,543	6,371	9,313	21,956	101.2
London (LGW)	16,720	21,438	18,399	19,247	19,452	23,664	23,825	21,920	3.6
Tokyo (NRT)	4,342	13,952	10,464	11,053	11,317	14,131	13,543	13,179	4.7
Singapore (SIN)	434	-	248	3,056	4,408	7,753	10,807	11,718	116.3
Paris (CDG)	10	4,964	8,777	8,133	7,114	6,569	5,950	7,852	- 2.2
Beijing (PEK)	-	-	-	-	-	1,579	1,699	6,743	106.7
Brussels (BRU)	1	1,539	4,110	578	2,452	5,676	7,835	5,956	7.7
Sao Paulo (GRU)	-	6,908	8,668	5,827	4,794	4,725	5,843	5,163	-9.8
Santiago (SCL)	0	6,423	7,795	5,400	4,611	5,448	5,856	5,084	-8.2
Osaka (KIX)	-	7,158	5,422	24	-	-	1,125	4,724	-2.7
Zurich (ZRH)	10	2,886	4,928	4,726	4,627	4,789	4,560	3,887	-4.6
Buenos Aires (EZE)	-	349	264	69	324	3,359	3,361	3,383	66.6
Macau (MFM)	-	-	-	239	346	-	1,641	1,865	13.7
Dubai (DXB)	-	-	-	-	578	957	1,616	1,720	43.9
Mexico City (MEX)	5,100	4,117	1,703	1,234	1,461	1,425	1,501	1,322	-4.9
Toronto (YYZ)	647	705	533	725	1,496	868	850	870	10.3
Segment-based Measurement									
Airport	1990	2000	2001	2002	2003	2004	2005	2006	01-06 (%)
Total	62,621	121,118	107,217	88,464	95,227	105,205	103,926	110,625	0.6
Top 10	40,953	94,529	87,847	77,587	77,369	92,403	92,396	101,521	2.9
Frankfurt (FRA)	22,442	29,950	20,380	22,233	21,845	22,392	17,930	26,829	5.7
London (LGW)	16,531	21,342	18,338	19,027	19,414	23,682	23,745	21,966	3.7
Tokyo (NRT)	1,969	13,062	9,562	10,163	10,383	13,294	13,483	12,792	6.0
Brussels (BRU)	1	1,539	4,110	2,134	4,080	8,337	10,680	8,956	16.9
Paris (CDG)	10	4,960	8,746	8,097	7,090	6,475	5,927	8,879	0.3
Sao Paulo (GRU)	-	7,292	8,617	5,851	5,053	4,723	5,801	5,114	-9.9
Santiago (SCL)	-	6,360	7,783	5,381	4,595	5,434	5,822	5,077	-8.2
Osaka (KIX)	-	7,143	5,403	24	-	-	1,125	4,700	-2.7
Zurich (ZRH)	-	2,880	4,909	4,677	4,621	4,738	4,531	3,865	-4.7
Buenos Aires (EZE)	-	-	-	-	288	3,329	3,351	3,343	0.2
Mexico City (MEX)	10,653	12,840	3,558	1,235	1,460	1,501	2,748	3,331	-1.3
Seoul (ICN)	-	8,789	8,793	3,752	8,949	4,850	1,500	2,353	-23.2
Toronto (YYZ)	559	697	535	729	876	1,243	1,333	870	10.2
Guadalajara (GDL)	795	857	644	389	663	297	298	293	-14.6
Montreal (YUL)	16	161	143	66	113	145	121	240	10.9
San Jose (SJO)	0	575	298	489	406	351	269	228	-5.3
Monterrey (MTY)	1,073	154	159	208	340	326	221	210	5.8
Guatemala City (GUA)	178	25	23	190	413	341	310	196	53.0
Montreal (YMX)	17	-	-	-	-	-	-	149	
Koeln/Bonn (CGN)	-	-	3,934	2,198	2,374	527	534	137	-48.9

Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: Jan. 2007.
Note: PVG, PEK, and EZE's growth rates show average growth rate between 2004 and 2006.

Table 16 shows major DFW partner airports by service type in 2006. In both market- and segment-based air freight performance, scheduled passenger/cargo combination service showed similar trends. The same airports appeared in both market- and segment-based rankings. By handling 22,000 tons of air freight in 2006, LGW occupied the highest position in both market- and segment-based scheduled passenger/cargo combination services, followed by FRA with 14,000 tons, NRT with 13,000 tons, CDG with 6,000 tons, and SCL with 6,000 tons.

However, scheduled all cargo service showed differences in trends between market- and segment-based air freight volumes. As for market-based performance, Asian airports generally ranked higher: TPE, ICN, HKG, PVG, SIN, and HKG respectively handled 86,000 tons, 23,000 tons, 22.000 tons, 15,000 tons, 12,000 tons, and 7,000 tons of freight in 2006. But European airports such as FRA, BRU, and CDG also appeared on the list of top airports by handling 13,000 tons, 6,000 tons, and 2,000 tons of freight in 2006. On the other hand, European airports such as FRA, BRU, and CDG ranked highest in segment-based air freight volumes by handling 13,000 tons, 9,000 tons and 3,000 tons freight in 2006. They were followed by MEX at 2,000 tons, ICN at 488 tons and CGN at 105 tons.

These trends show that scheduled all cargo service relies heavily on Asian airports for market-based air freight, while it depends on European airports and Latin American airports for segment-based air freight.

Non-scheduled and scheduled all cargo services experienced similar trends. ICN and PVG, two Asian airports, accounted for a large portion of market-based air freight volume. Meanwhile, European and North American airports reported high volumes of segment-based air freight. However, performance variations did exist, especially in terms of segment-based air freight at some airports. For example, ICN handled 6,217 tons of segment-based air freight in 2003, but its performance dropped to 226 tons in 2005, and then it rose to 711 tons in 2006. Calgary (YYC) handled 339 tons of segment-based air freight in 2005, but there was no traffic volume recorded in 2006. And Las Palmas (LPA) recorded no air freight prior to 2006.

Table 16: Major Partner Airports of DFW by Service Type in 2006 (tons)

Rank	Market-based Air Freight Performance			Segment-based Air Fright Performance		
	Code	Airport	Freight	Code	Airport	2006
-	Total		314,223	Total		110,625
Total	Scheduled Combination total		82,062	Scheduled Combination total		81,995
1	LGW	London, UK	21,920	LGW	London, UK	21,966
2	FRA	Frankfurt, Germany	13,953	FRA	Frankfurt, Germany	13,963
3	NRT	Tokyo, Japan	12,838	NRT	Tokyo, Japan	12,792
4	CDG	Paris, France	5,951	CDG	Paris, France	5,912
5	GRU	Sao Paulo, Brazil	5,145	GRU	Sao Paulo, Brazil	5,096
6	SCL	Santiago, Chile	5,084	SCL	Santiago, Chile	5,077
7	KIX	Osaka, Japan	4,724	KIX	Osaka, Japan	4,700
8	ZRH	Zurich, Switzerland	3,887	ZRH	Zurich, Switzerland	3,865
9	EZE	Buenos Aires, Argentina	3,383	EZE	Buenos Aires, Argentina	3,343
10	MEX	Mexico City, Mexico	1,321	MEX	Mexico City, Mexico	1,317
11	ICN	Seoul, South Korea	1,155	ICN	Seoul, South Korea	1,155
12	YYZ	Toronto, Canada	867	YYZ	Toronto, Canada	868
13	GDL	Guadalajara, Mexico	291	GDL	Guadalajara, Mexico	290
14	YUL	Montreal, Canada	240	YUL	Montreal, Canada	240
15	SJO	San Jose, Costa Rica	227	SJO	San Jose, Costa Rica	228
Total	Scheduled All Cargo Total		189,756	Scheduled All Cargo Total		27,274
1	TPE	Taipei, Taiwan	86,350	FRA	Frankfurt, Germany	12,595
2	ICN	Seoul, South Korea	23,016	BRU	Brussels, Belgium	8,956
3	HKG	Hong Kong, China	21,889	CDG	Paris, France	2,967
4	PVG	Shanghai, China	15,251	MEX	Mexico City, Mexico	2,012
5	FRA	Frankfurt, Germany	12,652	ICN	Seoul, South Korea	488
6	SIN	Singapore, Singapore	11,718	CGN	Koeln/Bonn, Germany	105
7	PEK	Beijing, China	6,743	YVR	Vancouver, Canada	77
8	BRU	Brussels, Belgium	5,956	FPO	Freeport, Bahamas	40
9	CDG	Paris, France	1,901	HKG	Hong Kong	32
10	MFM	Macau, Macau	1,865	GDL	Guadalajara, Mexico	3
Total	Non-scheduled Combination Total		53	Non-scheduled Combination Total		65
1	KWI	Kuwait, Kuwait	37	SAL	San Salvador, El Salvador	24
2	SAL	San Salvador, El Salvador	12	CGN	Koeln/Bonn, Germany	21
3	YYZ	Toronto, Canada	3	HHN	Hahn, Germany	16
Total	Non-scheduled All Cargo Total		42,353	Non-scheduled All Cargo Total		1,291
1	ICN	Seoul, Korea	32,368	ICN	Seoul, Korea	711
2	PVG	Shanghai, China	9,335	FRA	Frankfurt, Germany	271
3	FRA	Frankfurt, Germany	271	YMX	Montreal, Canada	149
4	YMX	Montreal, Canada	149	LPA	Las Palmas, Spain	41
5	HKG	Hong Kong, China	66	PTY	Panama City, Panama	39

Source: BTS website, Accessed: June 2007.

As shown in Table 17, American Airlines was the leading air carrier for passenger/cargo combination service in both market- and segment-based freight. In 2006 alone, American Airlines carried nearly 65,000 tons of freight, or nearly 79 percent of total passenger/cargo combination tonnage. The air carrier's international hub is located at DFW, covering Asia (mainly Japan) and Europe. Next in ranking were British Airways, Lufthansa, and Korean Air Lines.

All cargo service exhibited different behavior between market- and segment-based air freight performance. Seven Asian air carriers—EVA Airways, China Airlines, Singapore Airlines, Korean Airlines, China Cargo Airline, Cathay Pacific Airways, and Air China—accounted for 92.0 percent of total scheduled all cargo market-based tonnage in 2006.

On the other hand, both European air carriers, such as Lufthansa German Airlines and Compagnie National Air France, and Asian air carriers, such as Singapore Airlines and Korean Airlines, shared the scheduled all cargo segment-based air freight by respectively accounting for 64.9 percent and 34.8 percent tonnage in 2006. Lufthansa Airlines recorded the highest volume of segment-based air freight in scheduled all cargo service at 13,000 tons, and Compagnie National Air France at 5,000 tons in 2006. Singapore Airlines recorded 9,000 tons and Korean Airlines handled 488 tons.

As for non-scheduled all cargo service, Southern Air and Korean Airlines ranked highest in market-based air freight performance at more than 22,000 tons and 19,000 tons in 2006. In doing so, they shared 98.5 percent of total market-based air freight tonnage. However, a larger number of non-scheduled all cargo carriers participated in segment-based air freight: Southern Air carried 653 tons, followed by Gemini Air Cargo Airways at 139 tons, World Airways at 132 tons, both Atlas Air and Polar Air Cargo Airways at 74 tons.

Those non-scheduled all cargo carriers showed high variations in their air freight performances. Southern Air first appeared on the list of top air carriers list in 2006, while Korean Airlines recorded rapid decreases and increases annually although it provided continuous non-scheduled all cargo service. On the other hand, Air Atlanta Icelandic handled over 6,000 tons in 2005, but it didn't record any air freight volume in 2006. Kalitta Air, Evergreen Airlines, and Avia Leasing Company also recorded no segment-based air freight volumes in 2006.

Table 17: Air Carrier Level Air Freight of DFW by Service Type in 2006 (tons)

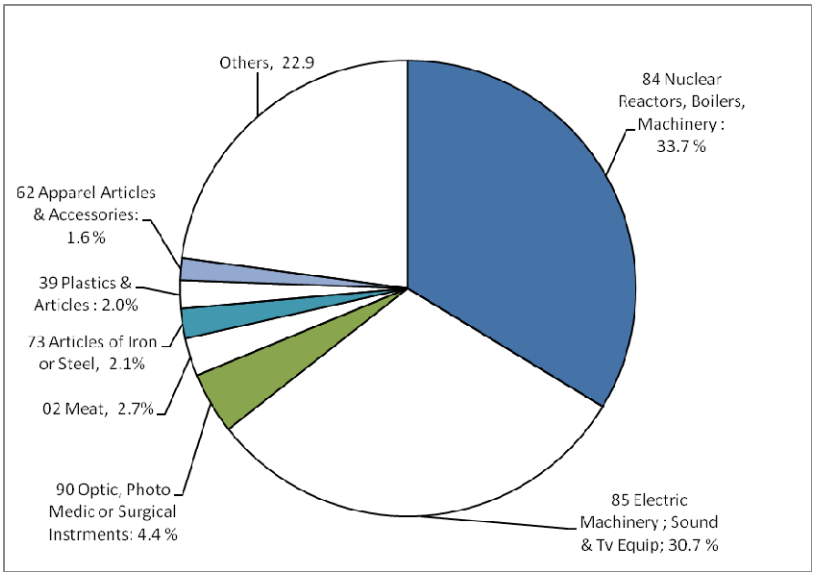
Rank	Market-based Measurement		Segment-based Measurement	
	Air Carrier	Freight	Carrier	2006
-	Total	314,223		110,625
Total	Scheduled Combination Total	82,062	Scheduled Combination Total	81,995
1	American Airlines Inc.	65,062	American Airlines Inc.	64,896
2	British Airways Plc	9,635	British Airways Plc	9,662
3	Lufthansa German Airlines	6,124	Lufthansa German Airlines	6,145
4	Korean Air Lines Co. Ltd.	1,155	Korean Air Lines Co. Ltd.	1,155
5	Taca Int'l Airlines	72	Taca Int'l Airlines	72
Total	Scheduled All Cargo Total	189,756	Scheduled All Cargo Total	27,274
1	Eva Airways Corporation	50,810	Lufthansa German Airlines	12,700
2	China Airlines Ltd.	35,540	Singapore Airlines Ltd.	8,987
3	Singapore Airlines Ltd.	29,522	Compagnie Nat'l Air France	4,979
4	Korean Air Lines Co. Ltd.	22,913	Korean Air Lines Co. Ltd.	488
5	China Cargo Airline	16,229	Cathay Pacific Airways Ltd.	77
6	Cathay Pacific Airways Ltd.	13,827	United Parcel Service	42
7	Lufthansa German Airlines	12,757		
8	Air China	5,645		
9	Compagnie Nat'l Air France	1,901		
10	Federal Express Corporation	570		
Total	Non-scheduled Combination Total	53	Non-scheduled Combination Total	65
1	Omni Air Express	49	Omni Air Express	61
2	Continental Air Lines Inc.	3	Continental Air Lines Inc.	3
3	Aeromexico	1	Aeromexico	1
Total	Non-scheduled All Cargo Total	42,353	Non-scheduled All Cargo Total	1,291
1	Southern Air Inc.	22,486	Southern Air Inc.	653
2	Korean Air Lines Co. Ltd.	19,217	Gemini Air Cargo Airways	139
3	Gemini Air Cargo Airways	139	World Airways Inc.	132
4	World Airways Inc.	132	Atlas Air Inc.	74
5	Atlas Air Inc.	74	Polar Air Cargo Airways	74
6	Polar Air Cargo Airways	74	Korean Air Lines Co. Ltd.	57
7	Federal Express Corporation	66	Antonov Design Bureau	41
8	Antonov Design Bureau	41	Florida West Airlines Inc.	39
9	Florida West Airlines Inc.	39	Abx Air, Inc.	28
10	Abx Air, Inc.	28	Centurion Cargo Inc.	26

Source: BTS website, Accessed: June 2007.

Some 269,392 tons of commodities were carried via air transportation in 2006, and their dollar value reached to nearly $42 billion. The average dollar value was $154,494 per ton. As shown in Figure 3, DFW's air freight traffic relied heavily on two categories of commodities under the 2-digit commodity classification system. Category 84—which includes nuclear reactors, boilers, and machinery—represented 33.7 percent of DFW's total air tonnage. And category 85—which includes electric machinery, sound equipment, and TV equipment—represented 30.7 percent. Moreover, category 85 placed first in terms of dollar value at $23 billion, while category 84 was second at $11 billion in 2006. This resulted in a high unit value per shipped ton.

In addition, apparel articles and accessories were included as major commodity groups. Table 18 contains more detailed explanation on 4-digit commodity classification for categories 84 and 85.

Figure 3: Major Commodities of DFW in 2006



Source: USA Trade Online, "The Trade Data," Online available: http://www.usatradeonline.gov, Accessed: May 2007.
Note: Appendix H provides major commodities' performance data in detail.

Table 18: Top 45 4-digit Commodities of DFW (tons, $1000)

Rank	Commodity	SWT	Value	$/ton
-	Total	269,392	41,619,339	154,494
1	8471 Automatic Data Process Machines; Magn Reader Etc.	24,180	3,634,689	150,319
2	8525 Trans Appar For Radiotele Etc.; Tv Camera & Rec	19,838	8,275,316	417,145
3	8431 Parts For Machinery Of Headings 8425 To 8430	16,247	676,020	41,608
4	8517 Electric Apparatus For Line Telephony Etc., Parts	16,156	5,066,941	313,622
5	8473 Parts Etc. For Typewriters & Other Office Machines	15,933	1,748,418	109,736
6	0205 Meat Of Horses, Asses, Mules, Hinnies Fr, Chld, Fz	7,003	34,669	4,951
7	8504 Elec Trans, Static Conv & Induct, Adp Pwr Supp, Pt	6,307	433,381	68,713
8	8542 Electronic Integrated Circuits & Microassembl, Pts	6,147	5,763,621	937,556
9	8481 Taps, Cocks, Valves Etc. For Pipes, Tanks Etc., Pts	5,611	177,170	31,573
10	8544 Insulated Wire, Cable Etc.; Opt Sheath Fib Cables	4,990	134,025	26,861
11	8479 Machines Etc. Having Individual Functions Nesoi, Pt	4,871	1,078,225	221,375
12	8411 Turbojets, Turbopropellers & Oth Gas Turbines, Pts	4,526	1,984,489	438,464
13	8529 Parts For Television, Radio And Radar Apparatus	4,055	526,393	129,815
14	8536 Electrical Apparatus For Switching Etc., Nov 1000 V	3,606	217,063	60,196
15	8507 Electric Storage Batteries, Incl Separators, Parts	2,873	190,715	66,381
16	8543 Electrical Mach Etc., With Ind Functions Nesoi, Pts	2,730	562,092	205,887
17	8414 Air Or Vac Pumps, Compr & Fans; Hoods & Fans; Pts	2,535	105,003	41,414
18	9801 Expts Of Repaired Impts; Impts Of Returned Expts	2,422	740,002	305,507
19	0304 Fish Fillets & Oth Fish Meat, Fresh, Chill Or Froz	2,352	16,055	6,827
20	8526 Radar Apparatus, Radio Navig Aid & Remote Cont App	2,163	549,313	253,998

Rank	Commodity	SWT	Value	$/ton
21	9018 Medical, Surgical, Dental Or Vet Inst, No Elec, Pt	2,102	344,004	163,640
22	2106 Food Preparations Nesoi	2,056	12,726	6,189
23	8413 Pumps For Liquids; Liquid Elevators; Parts Thereof	1,847	71,544	38,745
24	3004 Medicaments Nesoi, Mixed Or Not, In Dosage Etc. Fm	1,810	535,289	295,667
25	8803 Parts Of Balloons Etc., Aircraft, Spacecraft Etc.	1,754	818,526	466,562
26	9030 Oscilloscopes, Spectrum Analyzers Etc., Parts Etc.	1,637	291,933	178,328
27	8538 Parts For Elec Appar Etc. Of Head 8535, 8536 & 8537	1,617	52,761	32,627
28	8483 Transmission Shafts, Bearings, Gears Etc.; Parts	1,586	45,602	28,758
29	8708 Parts & Access For Motor Vehicles (head 8701-8705)	1,583	52,664	33,273
30	9401 Seats (except Barber, Dental, Etc.), And Parts	1,522	88,962	58,453
31	7219 Fl-rl Stainless Steel Products, Not Und 600mm Wide	1,445	2,830	1,959
32	8464 Machine Tools For Working Stone, Etc. & Glass	1,360	384,158	282,552
33	4202 Travel Goods, Handbags, Wallets, Jewelry Cases Etc.	1,313	41,896	31,917
34	2804 Hydrogen, Rare Gases And Other Nonmetals	1,286	129,254	100,487
35	3926 Articles Of Plastics (inc Polymers & Resins) Nesoi	1,257	38,826	30,899
36	8456 Machine Tools For Material Removal By Laser Etc.	1,255	379,343	302,224
37	9032 Automatic Regulating Or Control Instruments; Parts	1,249	113,976	91,278
38	6203 Men's Or Boys' Suits, Ensembles Etc., Not Knit Etc.	1,245	17,555	14,105
39	8518 Microphones; Loudspeakers; Sound Amplifier Etc., Pt	1,238	65,862	53,195
40	8514 Industrial Or Lab Elec Furnaces Etc., Parts	1,176	286,581	243,643
41	7318 Screws, Bolts, Nuts, Washers Etc., Iron Or Steel	1,106	27,354	24,727
42	8207 Interchange Tools For Hand- Or Machine-tools, Bmpt	1,059	74,305	70,157

Rank	Commodity	SWT	Value	$/ton
43	8534 Printed Circuits	1,038	76,998	74,174
44	7307 Tube Or Pipe Fittings, Of Iron Or Steel	1,016	16,107	15,849
45	7304 Tubes, Pipes Etc., Seamless, Iron Nesoi & Steel	1,007	4,755	4,720

Source: USA Trade Online, "The Trade Data," Online available: http://www.usatradeonline.gov, Accessed: March 2007.
Note: See Appendix H for more detailed air trade performance data under 6-digit commodity classification system.

Table 19 shows that air freight volumes of six Asian countries grew by an average of 23.3 percent over the 2001-2006 period. As a result, their share in DFW's total air freight rose to 71.9 percent in 2005. Specifically, DFW's exports to Asia recorded a 15.9 percent growth rate between 2001 and 2006, while DFW's imports from Asia increased by 28.3 percent.

These trends show two facts. First, DFW relies heavily on Asian countries for international freight traffic and its dependency on Asia has grown over time. Second, its incoming air freight is more dependent on Asia than its outgoing air freight. And its incoming air freight grew at a faster rate than outgoing air freight in most countries. Therefore, once again, there is an imbalance in directional freight.

Among its six major partner countries, Japan recorded the lowest average growth rate over the 2001-2006 period at 2.3 percent. Its air freight performance reached the lowest level in history at 11,000 tons by decreasing 30.8 percent in 2002. Then, it began to recover in 2003, climbing to 18,000 tons in 2005. This represented a 12.8 percent average growth rate between 2002 and 2006.

Other countries were successful in increasing their air freight volumes even in 2001, although 9/11 led to an overall adverse impact. As a result, their air freight performances were able to record high average growth rates over the 2001-2006 period. This was especially true for incoming air freight.

China, Hong Kong, and Singapore experienced exceptional rapid growth compared to other Asian countries listed. Air freight performance between DFW and China recorded the highest growth rate at 67.0 percent between 2004 and 2005. DFW's air freight imports from China grew by 87.6 percent to 25,000 tons in 2006, while DFW's air freight exports to China increased by 23.5 percent to 6,000 tons. As a result, the country attained third place in the volume of market-based air freight. Similarly, incoming air freight from Singapore expanded by 46.5 percent between 2002 and 2006, while outgoing air freight to Singapore increased by 25.0 percent over the same time period. Hong Kong's air freight performance showed a significantly high growth rate of 136 percent in 2006. Its overall air freight volume grew 54.1 percent between 2002 and 2006.

By comparison, South Korea and Taiwan experienced relatively moderate growth. However, their average growth rates of 17.7 percent and 18.3 percent were still higher than DFW's average air freight performance growth rate of 14.5 percent. These two countries shared the highest

portion in DFW's market-based air freight in 2006. Taiwan accounted for 37.5 percent of DFW's air freight imports and 23.8 percent of its air freight exports. On the other hand, South Korea accounted for 22.2 percent of DFW's imports and 18.5 percent of DFW's exports.

Table 19: Trans-Pacific Air Freight Performance Trends of DFW (tons)

	Country	1990	2000	2001	2002	2003	2004	2005	2006	01-05 (%)
TOTAL	DFW Total	63,323	167,217	159,390	163,168	182,712	261,847	293,936	314,223	14.5
	Sub-total	13,136	89,248	79,163	90,400	107,477	175,695	198,792	225,793	23.3
	China	-	-	-	-	-	11,229	24,546	31,328	67.0
	Hong Kong	1,760	74	666	3,894	3,543	6,371	9,313	21,956	54.1
	Japan	4,388	21,110	15,999	11,077	11,317	14,131	14,667	17,902	2.3
	Korea	74	20,977	24,995	27,309	33,653	55,594	54,582	56,538	17.7
	Singapore	434	-	248	3,056	4,408	7,753	10,807	11,718	39.9
	Taiwan	6,480	47,087	37,255	45,063	54,555	80,617	84,877	86,350	18.3
From DFW	DFW Total	37,926	75,202	71,928	65,541	70,655	103,831	117,255	125,414	11.8
	Sub-total	6,631	38,257	35,910	33,010	32,942	57,304	64,323	75,185	15.9
	China	-	-	-	-	-	4,110	6,964	6,266	23.5
	Hong Kong	125	74	174	166	59	398	839	6,252	147.7
	Japan	1,843	8,911	7,214	4,880	4,989	6,030	6,171	7,006	-0.6
	Korea	73	9,624	9,173	8,221	9,160	15,434	18,557	23,161	20.4
	Singapore	434	-	-	1,095	1,090	2,142	1,851	2,676	25.0
	Taiwan	4,157	19,648	19,349	18,648	17,644	29,189	29,941	29,825	9.0
To DFW	DFW Total	25,397	92,016	87,462	97,628	112,057	158,016	176,681	188,810	16.6
	Sub-total	6,505	50,991	43,253	57,389	74,534	118,392	134,469	150,608	28.3
	China	-	-	-	-	-	7,119	17,582	25,063	87.6
	Hong Kong	1,636	-	492	3,728	3,484	5,973	8,475	15,704	43.3
	Japan	2,545	12,199	8,784	6,198	6,328	8,101	8,496	10,897	4.4
	South Korea	1	11,353	15,823	19,088	24,493	40,160	36,024	33,378	16.1
	Singapore	-	-	248	1,961	3,318	5,611	8,957	9,042	46.5
	Taiwan	2,323	27,439	17,906	26,415	36,911	51,428	54,936	56,525	25.6

Source: BTS website, Accessed: January 2007.

Note 1) Market-based air freight performance data.

2) China: 2004-2006 average growth rate, Hong-Kong and Singapore: 2002-2006 average growth rate

Air Cargo Performance of Houston's George Bush Intercontinental Airport (IAH)

As shown in Table 20, Houston's George Bush Intercontinental Airport (IAH)'s air freight traffic decreased slightly from 334,595 tons in 2004 to 327,141 tons in 2005. Its performance recovered to 359,052 tons in 2006. As a result, IAH recorded 7.4 percent average annual growth rate over the period of 2001-2006. It should be noted that both domestic and international air freight tonnages experienced the same average growth rates over the 2001-2006 period.

Table 20: Air Freight Trends of George Bush Intercontinental Airport (tons)

Region	2000	2001	2002	2003	2004	2005	2006	01-06 (%)
Total	263,130	250,777	262,114	316,890	334,595	327,141	359,052	7.4
Domestic	147,595	135,780	150,924	185,050	192,208	188,428	194,362	7.4
International Total	115,535	114,996	111,191	131,839	142,387	138,713	164,690	7.4
Share of International (%)	43.9	45.9	42.4	41.6	42.6	42.4	45.9	

Source: Department of Aviation, Monthly Summary Report for Houston Airport System, each year.
Available: http://www.fly2houston.com/newsTraffic.

IAH's performance differed from that of DFW. Table 21 reveals that IAH's segment-based air freight recorded a slightly higher average annual growth rate than its market-based air freight. Segment-based air freight performance grew by 9.6 percent to 176,549 tons in 2006, up from 117,044 tons in 2001. On the other hand, market-based air freight increased by 9.3 percent, up from 106,548 tons in 2001 to 166,300 tons in 2006. The higher performance on segment-based air freight seems to indicate that IAH is growing as an intermediate-stop airport rather than an origin or final destination for international air freight.

A second distinction is that IAH has relied more on passenger/cargo combination flight service than on all cargo flight service for international air freight delivery. Some 72.1 percent of IAH's total segment-based air freight was carried by scheduled passenger/cargo combination service while, scheduled all cargo service accounted for 24.7 percent in 2005. Similarly, scheduled passenger/cargo combination service's share of IAH's total segment-based air freight was 65.6 percent in 2005, while scheduled all cargo service was 31.7 percent. By comparison, DFW showed higher performance on all cargo service in both air freight performance measurements.

Although scheduled all cargo service was not the main method for air freight transport, IAH experienced rapid all cargo flight service growth in both market- and segment-based air freight. Between 2001 and 2005, all cargo flight service increased by 20.5 percent annually in market-based transport and 21.4 percent annually in segment-based transport. These average annual growth rates were more than twice as large as IAH's average air freight growth over the period of 2001-2006. All cargo flight service increased its share of total air freight to 24.7 percent in 2006, up from 15.1 percent in 2001. And all cargo flight service's share of segment-based air freight grew to 31.7 percent in 2006, up from 19.1 percent in 2001.

All cargo flight service's air freight performance grew especially fast for arriving air freight: 50.9 percent market-based and 32.8 percent segment-based arriving air freight measurement over the period of 2001 to 2006. However, their shares of total IAH incoming air freight were still one-half of their shares in total IAH outgoing air freight.

The third distinction is that IAH showed higher growth in air freight exports. In market-based measurements, outgoing air freight volume of 86,302 tons in 2006 was higher than incoming air freight levels. Similarly, segment-based air freight exports of 93,042 tons was larger than outgoing air freight volume of 83,507 tons. This shows that IAH has been a preferred gateway for exported goods.

Non-scheduled passenger/cargo combination service showed no activity in both market- and segment-based air freight traffic. However, non-scheduled all cargo service showed robust growth over the 2001-2006 period; but, its share of total IAH's market or segment-based air freight performance was small.

Table 21: International Air Freight Trends of IAH by Service Type (tons)

Market-based Measurement										
Port	Class	1990	2000	2001	2002	2003	2004	2005	2006	01-06 (%)
Total	Total	60,998	107,563	106,548	112,640	129,611	135,104	148,722	166,300	9.3
	F	47,303	91,194	87,706	90,326	94,724	100,931	104,523	119,974	6.5
	G	12,236	13,849	16,134	16,920	26,435	29,454	38,789	41,007	20.5
	L	-	-	-	-	84	-	-	1	
	P	1,460	2,521	2,708	5,394	8,368	4,719	5,411	5,317	14.4
Depar-ture	Total	40,899	54,952	55,784	54,272	66,181	66,197	79,143	86,302	9.1
	F	29,515	39,935	38,876	35,653	41,336	43,302	47,701	53,068	6.4
	G	10,454	12,816	14,556	13,689	17,040	18,999	26,878	28,661	14.5
	L	-	-	-	-	74	-	-	-	
	P	930	2,201	2,352	4,930	7,731	3,896	4,564	4,574	14.2
Arrival	Total	20,099	52,611	50,765	58,368	63,429	68,907	69,580	79,997	9.5
	F	17,787	51,258	48,831	54,672	53,388	57,630	56,822	66,906	6.5
	G	1,782	1,033	1,578	3,231	9,395	10,455	11,911	12,347	50.9
	L	-	-	-	-	10	-	-	1	
	P	530	320	356	464	637	823	847	743	15.9
Segment-based Measurement										
Port	Class	1990	2000	2001	2002	2003	2004	2005	2006	01-06 (%)
Total	Total	74,525	109,907	111,391	117,044	141,350	141,371	162,620	176,549	9.6
	F	66,515	91,022	87,437	86,464	89,612	96,104	99,357	115,815	5.8
	G	6,089	16,204	21,221	25,412	44,017	41,488	58,064	55,895	21.4
	L	-	-	-	0	84	-	-	-	
	P	1,921	2,681	2,733	5,167	7,638	3,779	5,200	4,838	12.1
Depar-ture	Total	39,084	55,821	58,138	56,653	73,622	71,388	87,241	93,042	9.9
	F	37,896	39,793	38,849	33,387	38,020	40,006	44,262	50,005	5.2
	G	80	13,728	17,019	18,586	28,492	28,297	38,626	38,515	17.7
	L	-	-	-	0	74	-	-	-	
	P	1,108	2,300	2,269	4,680	7,035	3,085	4,353	4,522	14.8
Arrival	Total	35,442	54,086	53,254	60,391	67,729	69,984	75,379	83,507	9.4
	F	28,619	51,230	48,588	53,077	51,591	56,098	55,094	65,810	6.3
	G	6,009	2,475	4,202	6,826	15,525	13,192	19,438	17,380	32.8
	L	-	-	-	-	10	-	-	-	
	P	813	381	464	487	603	693	847	317	-7.4

Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: June 2007.

Unlike DFW, IAH relied heavily on European airports. Table 22 shows the top-10 airports consisted of London (LGW, STN, and LHR[3]), Amsterdam (AMS), Paris (CDG), Frankfurt (FRA), Luxembourg (LUX) and Glasgow (PIK), and Latin American airports such as Mexico City (MEX), Buenos Aires (EZE), and Sao Paolo (GRU). In 2006, the top-10 airports accounted for 81.9 percent of IAH's total market-based air freight, of which 72.1 percent involved European airports. By comparison, the top-10 airports accounted for 86.4 percent of IAH's total segment-based air freight, of which 70.7 percent involved European airports.

For 2006, LGW surpassed AMS in both market- and segment-based air freight. LGW's air freight recorded its lowest performance at 21,060 tons in 2003, down from 24,898 tons in 2001; but its performance began to recover thereafter.

AMS recorded less than average annual growth rates of 4.4 percent in market-based air freight and 6.2 percent in segment-based air freight during the 2001-2006 period. Those average growth rates were much smaller than IAH's overall air freight growth. As a result, AMS was overtaken by LGW. It recorded 29,200 tons in market-based air freight and 29,177 tons in segment-based air freight. The air freight performances at CDG, STN, and LHR also recorded less than the average annual growth rate over the same time period.

In addition to European airports, Mexico City (MEX) and Buenos Aires (EZE) were included on the top-10 list for market-based air freight. Sao Paulo (GRU) appeared on the list of the top-10 segment-based air freight handling airports. Those Latin American airports recorded relatively high average annual growth rates in both measurements. However, their shares of IAH's total air freight performance, at 6.1 percent and at 12.1 percent, were small.

The segment-based air freight performances were larger than those for market-based in most of Latin American airports. MEX's segment-based air freight volume of 16,033 tons in 2006 was larger than its market-based air freight volume of 6,358 tons. GRU also showed higher volumes of segment-based air freight. The conclusion is that IAH is a hub airport for air freight from/to Latin American countries.

Among Asian airports, only Tokyo was ranked in the top-10. However, its share of IAH's total air freight was quite small compared to what it achieved at DFW. In addition to NRT, Taipei (TPE) appeared on the list of top-20 airports. This may represent the beginning of IAH's attempt to expand its air freight services to Asia.

Table 22: Top 20 Partner Airports of IAH (tons, %)

Market-based Performance									
Airport	1990	2000	2001	2002	2003	2004	2005	2006	01-05
Total	60,998	107,563	106,548	112,640	129,611	135,104	148,722	166,300	9.3
Top 10	50,714	93,605	91,587	93,015	105,834	111,892	126,186	136,217	8.3
London (LGW)	16,321	26,390	24,898	21,166	21,060	23,638	26,537	32,991	5.8
Amsterdam (AMS)	8,174	22,457	23,502	26,110	27,519	31,198	31,131	29,200	4.4
Paris (CDG)	7,767	22,830	21,323	19,025	23,378	21,978	23,454	26,208	4.2
Luxembourg (LUX)	-	2,666	5,815	5,948	5,622	1,138	10,260	11,211	14.0
Frankfurt (FRA)	9,301	7,679	6,273	7,402	7,661	9,627	10,660	10,685	11.2
Mexico City (MEX)	4,825	2,834	2,752	2,172	7,350	7,318	8,107	6,358	18.2
Tokyo (NRT)	4,299	7,895	6,631	7,381	7,803	7,884	7,102	6,140	-1.5
London (STN)	23	14	-	-	608	4,844	4,305	5,537	6.9
London (LHR)	4	-	-	3,787	4,833	4,250	4,390	4,043	1.7
Buenos Aires (EZE)	-	839	393	23	-	16	240	3,844	57.8
Glasgow (PIK)	1,458	1,432	1,362	1,765	2,529	1,197	2,486	3,640	21.7
Dammam (DMM)	-	-	-	-	-	1,501	2,186	3,198	46.0
Sao Paulo (GRU)	-	1,708	1,840	1,764	2,390	3,285	3,223	2,992	10.2
Rio De Janeiro (GIG)	-	-	1,079	2,673	2,576	1,826	1,969	2,319	16.5
Taipei (TPE)	-	-	-	-	-	263	765	1,891	168.3
Ostend (OST)	-	-	-	16	10	-	-	1,738	-
San Jose (SJO)	127	425	650	1,064	942	1,237	1,364	1,346	15.7
Guadalajara (GDL)	606	792	419	317	454	98	550	1,185	23.1
Jeddah (JED)	-	-	-	-	8	406	730	935	51.7
San Salvador (SAL)	172	665	621	636	705	1,047	741	785	4.8
Segment-based Performance									
Origin/Destination	1990	2000	2001	2002	2003	2004	2005	2006	01-05
Total	74,525	109,907	111,391	117,044	141,350	141,371	162,620	176,549	9.6
Top 10	68,459	95,408	98,652	101,499	123,660	125,154	145,680	152,457	9.1
London (LGW)	16,018	26,268	24,815	21,134	20,994	23,487	26,434	32,903	5.8
Amsterdam (AMS)	16,194	22,449	25,647	28,945	30,961	33,774	32,638	29,177	2.6
Paris (CDG)	8,877	20,130	19,207	16,528	23,729	25,126	25,460	27,942	7.8
Mexico City (MEX)	25,685	5,033	5,646	6,753	15,871	14,734	18,573	16,033	23.2
Glasgow (PIK)	-	3,752	6,213	9,321	10,384	2,227	12,683	12,727	15.4
Frankfurt (FRA)	1,685	7,828	6,273	7,399	7,420	8,033	8,665	8,833	7.1
Luxembourg (LUX)	-	337	1,242	-	348	-	4,657	7,813	44.4
Tokyo (NRT)	-	7,895	6,631	7,238	7,784	7,841	7,257	6,269	-1.1
London (STN)	-	14	74	-	1,438	4,869	4,268	5,537	136.7
Sao Paulo (GRU)	-	1,700	2,902	4,182	4,731	5,063	5,045	5,224	12.5
Ostend (OST)	-	-	-	278	60	929	2,379	3,991	107.2
Buenos Aires (EZE)	-	-	-	-	-	30	119	3,870	
Guadalajara (GDL)	612	1,439	1,233	1,850	1,821	416	2,623	3,481	23.1
Gander (YQX)	60	339	753	1,823	4,440	1,387	1,366	1,443	13.9
San Jose (SJO)	3	425	651	1,064	1,522	1,231	1,358	1,337	15.5
Milan (MXP)	-	-	-	-	-	-	37	823	
Lima (LIM)	-	871	785	814	858	825	620	779	-0.2
Guatemala City (GUA)	525	581	510	544	665	772	613	679	5.9
Manchester (MAN)	-	21	-	77	4	433	540	647	22.2
Panama City (PTY)	154	3,282	1,195	571	723	826	851	628	-12.1

Data source: Bureau of Transportation Statistics, 'Aviation Statistics,' Online Available: http://www.transtats.bts.gov/databases.asp?Mode_ID=1&Mode_Desc=Aviation&Subject_ID2=0, Accessed: June 2007.

The same trends apply to different service types. As shown in Table 23, European and Latin American airports accounted for most of the air freight demand on scheduled passenger/cargo combination service, scheduled all cargo service, and even non-scheduled all cargo service. This is a unique characteristic of IAH.

It should be noted that some airports rely on scheduled passenger/cargo combination service, while others depend on scheduled all cargo service. LGW's air freight, for example, was performed by scheduled combination service, while LUX' air freight was transported by scheduled all cargo service.

Table 23: Major International Air Freight Route of IAH by Service Type in 2006 (tons)

Rank	Market-based Measurement			Segment-based Measurement		
	Code	Airport	Freight	Code	Airport	Freight
-	Total		166,300	Total		176,549
Total	Scheduled Combination Total		119,974	Scheduled Combination Total		115,815
1	LGW	London, UK	32,987	LGW	London, UK	32,894
2	AMS	Amsterdam, Netherlands	29,200	AMS	Amsterdam, Netherlands	29,177
3	CDG	Paris, France	19,665	CDG	Paris, France	19,615
4	FRA	Frankfurt, Germany	8,584	FRA	Frankfurt, Germany	8,531
5	NRT	Tokyo, Japan	6,140	NRT	Tokyo, Japan	6,269
6	LHR	London, UK	4,043	GRU	Sao Paulo, Brazil	5,224
7	EZE	Buenos Aires, Argentina	3,785	EZE	Buenos Aires, Argentina	3,797
8	GRU	Sao Paulo, Brazil	2,992	MEX	Mexico City, Mexico	1,678
9	GIG	Rio De Janeiro, Brazil	2,289	SJO	San Jose, Costa Rica	1,337
10	SJO	San Jose, Costa Rica	1,346	LIM	Lima, Peru	779
11	MEX	Mexico City, Mexico	1,027	GUA	Guatemala City, Guatemala	679
12	SAL	San Salvador, El Salvador	785	MAN	Manchester, UK	647
13	LIM	Lima, Peru	780	PTY	Panama City, Panama	628
14	TPE	Taipei, Taiwan	728	SAL	San Salvador, El Salvador	588
15	GUA	Guatemala City, Guatemala	681	MID	Merida, Mexico	517
Total	Scheduled All cargo Total		41,007	Scheduled All cargo Total		55,895
1	LUX	Luxembourg, Luxembourg	11,211	MEX	Mexico City, Mexico	14,348
2	CDG	Paris, France	6,543	PIK	Glasgow/Prestwick, UK	12,595
3	STN	London, UK	5,424	CDG	Paris, France	8,327
4	MEX	Mexico City, Mexico	5,324	LUX	Luxembourg, Luxembourg	7,813
5	PIK	Glasgow/Prestwick, UK	3,508	STN	London, UK	5,424
6	DMM	Dammam, Saudi Arabia	3,198	OST	Ostend, Belgium	3,486
7	FRA	Frankfurt, Germany	2,101	GDL	Guadalajara, Mexico	3,320
8	TPE	Taipei, Taiwan	1,163	FRA	Frankfurt, Germany	302
9	GDL	Guadalajara, Mexico	1,039	JED	Jeddah, Saudi Arabia	82
10	JED	Jeddah, Saudi Arabia	935	NTE	Nantes, France	79
Total	Non-scheduled Combination Total		1	Non-scheduled Combination Total		-
1	MST	Maastricht, Netherlands	1			
Total	Non-scheduled All Cargo Total		5,317	Non-scheduled All Cargo Total		4,838
1	OST	Ostend, Belgium	1,640	YQX	Gander, Canada	1,404
2	MXP	Milan, Italy	640	MXP	Milan, Italy	823
3	XCR	Chalons Sur Marne, France	384	OST	Ostend, Belgium	505
4	YQX	Gander, Canada	295	XCR	Chalons Sur Marne, France	414
5	AUA	Aruba, Aruba	231	CAY	Cayenne, French Guiana	322

Source: BTS website, Accessed: June 2007.

Turning to Table 24, Continental Airlines ranked first among scheduled passenger/cargo combination service providers in both market- and segment-based traffic by carrying 57,000 tons of international air freight. The air carrier followed by KLM Royal Dutch Airlines, British Airways, Compagnie National Air France, and Lufthansa.

In sum, those five scheduled passenger/cargo combination service providers accounted for 98.4 percent of market-based air freight and 98.9 percent of segment-based air freight performed in scheduled passenger/cargo combination service in 2006. In terms of scheduled all cargo service, Cargolux Airlines occupied the first place in both market- and segment-based air freight, followed by Compagnie National Air France. In 2005, Cargolux Airlines handled 18,000 tons of market-based air freight, while its performance in segment-based measurement reached 29,000 tons, nearly double that of market-based air freight performance. This shows that IAH is an air transportation hub for both Cargolux Airlines and Compagnie National Air France.

Global Supply System achieved high performance as a scheduled all cargo service provider of market-based air freight. China Airlines appeared on both scheduled passenger/cargo service and scheduled all cargo service provider lists only for market-based air freight. These air freight performances show that they serve intermediate-stop airports on their way from/to IAH.

Non-scheduled all cargo service was dominated by two air carriers—Atlas Air and Volga-Dnepr Airlines. In 2006, the two accounted for 55.5 percent of market-based air freight and 62.6 percent of segment-based air freight.

Table 24: Air Carrier Level Air Freight Performance by Service Type in 2006 (tons)

Rank	Market-based Measurement		Segment-based Measurement	
	Air Carrier	Freight	Air Carrier	Freight
-	Total	166,300	Total	176,549
Total	Scheduled Combination Total	119,974	Scheduled Combination Total	115,815
1	Continental Air Lines Inc.	57,267	Continental Air Lines Inc.	57,183
2	KLM Royal Dutch Airlines	22,594	KLM Royal Dutch Airlines	22,658
3	British Airways Plc	18,549	British Airways Plc	14,490
4	Compagnie Nat'l Air France	11,057	Compagnie Nat'l Air France	11,632
5	Lufthansa German Airlines	8,532	Lufthansa German Airlines	8,551
6	China Airlines Ltd.	728	Pakistan Int'l Airlines	647
7	Pakistan Int'l Airlines	647	Aeromexico	314
8	Aeromexico	314	Taca Int'l Airlines	239
9	Taca Int'l Airlines	239	Air Canada	46
10	Air Canada	47	Expressjet Airlines Inc.	41
Total	Scheduled All Cargo Total	41,007	Scheduled All Cargo Total	55,895
1	Cargolux Airlines Int'l S.A	17,736	Cargolux Airlines Int'l S.A	28,725
2	Global Supply System	7,525	Compagnie Nat'l Air France	14,571
3	Compagnie Nat'l Air France	6,702	Global Supply System	5,669
4	Saudi Arabian Airlines Corp	4,608	Saudi Arabian Airlines Corp	3,568
5	United Parcel Service	3,243	United Parcel Service	3,243
6	China Airlines Ltd.	1,163	Martinair Holland N.V.	-
Total	Non-scheduled Combination Total	-	Non-scheduled Combination Total	-
Total	Non-scheduled All Cargo Total	5,317	Non-scheduled All Cargo Total	4,838
1	Air Atlanta Icelandic	1,640	Volga-Dnepr Airlines	1,529
2	Volga-Dnepr Airlines	1,312	Gemini Air Cargo Airways	1,500
3	Gemini Air Cargo Airways	1,131	Antonov Design Bureau	588
4	Antonov Design Bureau	519	Air Atlanta Icelandic	505
5	Atlas Air Inc.	203	Atlas Air Inc.	203
6	Polyot Airlines	192	Polyot Airlines	192
7	Cielos De Peru	64	Cielos De Peru	81
8	Air Transport International	50	Air Transport International	51
9	Centurion Cargo Inc.	48	Centurion Cargo Inc.	48
10	Polar Air Cargo Airways	42	Polar Air Cargo Airways	42

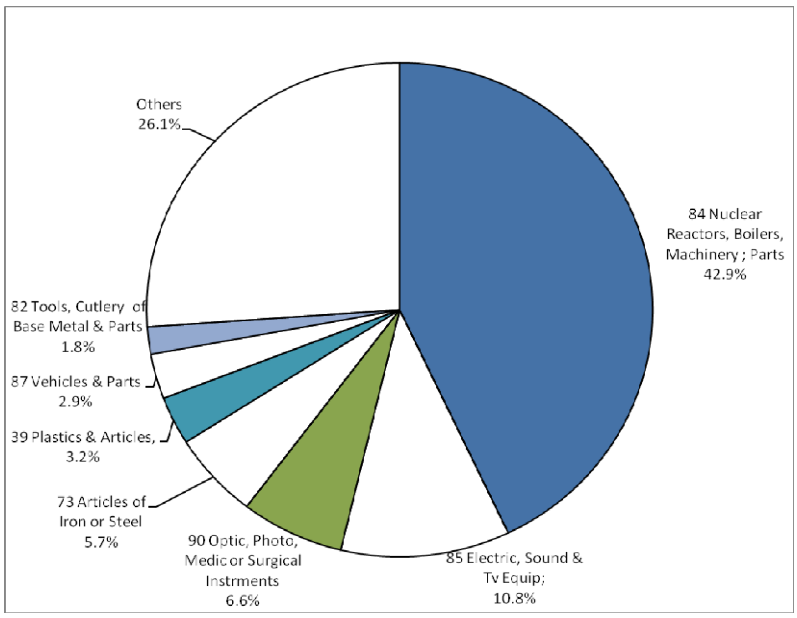
Source: BTS website, Accessed: January 2007.

IAH handled 154,378 tons of air freight, having a dollar value of $11 billion. Its total tonnage was much smaller than that of DFW. As shown in Figure 4, 2-digit classification commodities such as those falling within category 84 (including nuclear reactors, boilers and machinery) represented the largest portion at 42.9 percent, and those falling within category 85 (electric machinery, sound and TV equipment) accounted for the second-largest portion at 10.8 percent. In

addition, categories 90, 73, and 39 accounted for 6.6 percent, 5.7 percent, 3.2 percent, and 2.9 percent, respectively.

Those five 2-digit-classification categories are the same as DFW, although their shares of total air freight are different. However, IAH's list included two other categories, 82 and 87; and DFW also included an additional two, categories 2 and 62.

Figure 4: Major Commodities of IAH in 2006

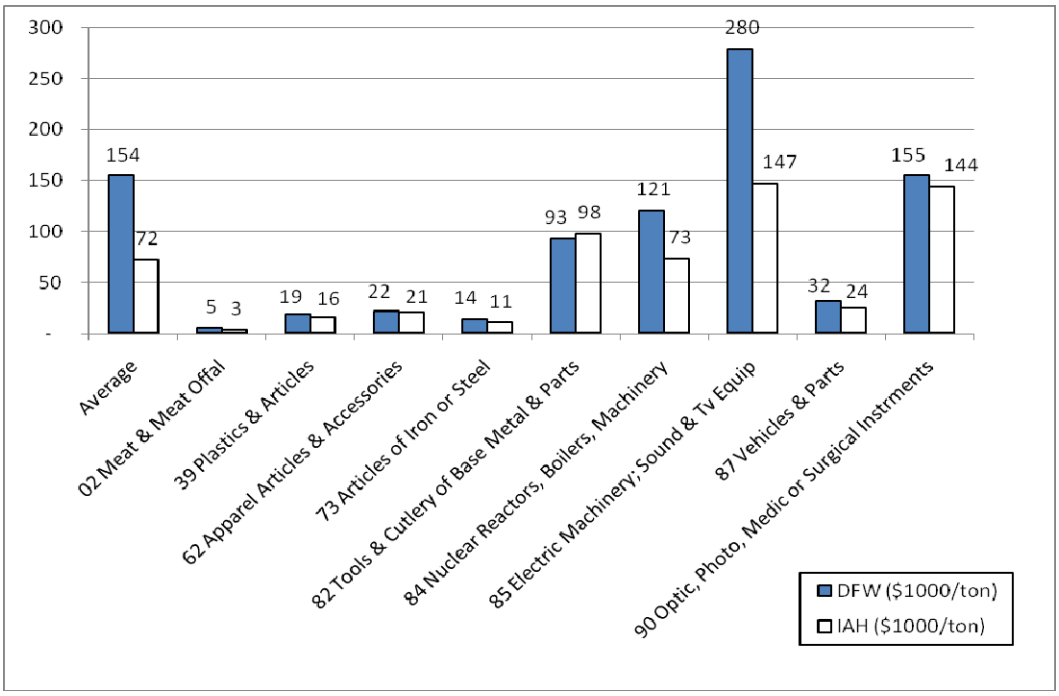


Source: USA Trade Online, "The Trade Data," Online available: http://www.usatradeonline.gov, Accessed: May 2007.
Note: Appendix I provides major commodities' performance data in detail.

IAH has two other notable characteristics. First, there is one dominant commodity group, category 84. As shown in Figure 5, category 84 alone accounted for 42.9 percent total traded commodities, nearly four times larger than the second-place commodity group, category 85. In the case of DFW, there were two dominant categories, category 84 and category 85, and they accounted for nearly two-thirds of DFW's total air trade performance in 2006.

Secondly, IAH's average unit value of traded goods—$72,000 per ton—was much lower than DFW's average unit value of $154,000 per ton in 2006. Among the top commodities, category 85 (electric machinery, sound and TV equipment) showed the largest difference in average unit values at $280,000 and $147,000. A more detailed look at commodities at each airport may explain the differences. For example, Table 25 shows that DFW recorded a high volume on 4-digit category 5425 (transmission for radio & TV, TV camera and recorders) having an average unit value was high at $417,145; but IAH recorded a relatively low volume, having an average unit value of $224,965. Moreover, DFW showed large volume of 4-digit category 8542 (electronic integrated circuits and micro-assembly parts) having high average value of $937,556. DFW recorded high volumes of digital, as well as non-digital monolithic integrated circuits (6-digit categories of 854221 and 854229). IAH did not.

Figure 5: Major Commodities' Average Value Comparison in 2006



Source: USA Trade Online, "The Trade Data," Online available: http://www.usatradeonline.gov, Accessed: May 2007.

Table 25: Comparison of Major Air Traded Commodities in Category 85 (tons)

	DFW			IAH		
	SWT	Value	$/ton	SWT	Value	$/ton
85 Electric Machinery Etc.; Sound Equip; TV Equip;	82,787	23,142,100	279,539	16,685	2,456,706	147,242
8504 Electric Transmission, Static Converter, Power Supply	6,307	433,381	68,713	1,205	101,105	83,910
8517 Electric Apparatus For Line Telephony Etc., Parts	16,156	5,066,941	313,622	2,618	1,262,381	482,198
8525 Transmission for Radio & TV; TV Camera & Recorder	19,838	8,275,316	417,145	612	137,582	224,965
852520 Transmission Incorporating Reception Apparatus	19,246	8,192,961	425,706	512	122,983	240,313
8529 Parts For Television, Radio And Radar Apparatus	4,055	526,393	129,815	980	107,342	109,550
8536 Electrical Apparatus For Switching Etc., Nov 1000 V	3,606	217,063	60,196	1,739	85,379	49,109
853649 Relays For Voltage Over 60v More But Not Over 1000v	329	15,729	47,807	303	11,712	38,624
8542 Electronic Integrated Circuits & Micro-assembly Parts	6,147	5,763,621	937,556	1,412	192,373	136,236
854221 Digital Monolithic Integrated Circuits	3,776	4,467,372	1,183,211	489	121,919	249,289
854229 Monolithic Integrated Circuits, Other Than Digital	1,908	1,156,766	606,234	827	61,203	74,030
8544 Insulated Wire, Cable Etc.; Opt Sheath Fiber Cables	4,990	134,025	26,861	1,804	80,712	44,744

Source: USA Trade Online, "The Trade Data," Online available: http://www.usatradeonline.gov, Accessed: May 2007.

Table 26 shows major IAH traded commodities for 2006 by 4-digit commodity classifications. Most of the 4-digit commodities belonged to leading 2-digit categories such as categories 84, 85, 90, 73, 39, 87 and 82. Among the 4-digit categories belonging to category 84 are 8431, 8425 to 8430, 8471, and 8481. It should be noted that category 8431 was a dominating product in IAH's air trade. It alone accounted for 23.2 percent of IAH's air trade in terms of shipping weight tons and 17.1 percent of IAH's total air trade performance in terms of value. However, its average

value per unit shipping weight ton at $53,274, was relatively lower than IAH's average value of $72,072, because its share in IAH's total money value performance was less than its share in IAH's shipping weight ton performance. On the other hand, 4-digit category 8411 showed high average value per unit shipping weight ton. Its air trade recorded 2,000 tons, 10th largest among 4-digit categories; but total money value of $954 million was 4th largest. As a result, its value per unit shipping weight ton reached to $442,111 in 2006, nearly 6 times higher than the average value of IAH.

There are several 4-digit categories which do not belong to the 2-digit categories appearing on the lists of top traded commodities. For example, 4-digit category 9801 (exports of repaired imports and imports of returned exports) occupied the 16th position by recording 15,000 tons in shipping weight, and category 2710 (oil—not crude—from petroleum and bitum mineral) ranked in 21st place in 2006. In addition, category 4016 (articles of unharded vulcanized rubber), category 9401 (seats and parts), category 3304 (beauty, make-up and skin-care preparations and manicure), category 3602 (prepared explosives), category 8803 (parts of balloons, aircraft and spacecraft), and category 0302 (fresh or chilled fish) were also included in the top-45 lists.

Among those 4-digit categories, both category 9801 and category 8803 showed high performance in money value terms, compared to its ton-based performance. Consequently, their values per unit of shipping weight were high at $227,410 and $378,798 in 2006. Alternatively, average values of both category 2710 and 0302 showed low value per unit of shipping weight. These commodities may use air transportation because they are perishable. That is, delivery time can be the most important factor in deciding which mode of transportation to use for shipping

Table 26: Top 45 4-digit Commodities of IAH (tons, $1000)

Rank	Commodity	SWT	Value	$/ton
-	Total	154,378	11,126,382	72,072
1	8431 Parts For Machinery Of Headings 8425 To 8430	35,770	1,905,619	53,274
2	8481 Taps, Cocks, Valves Etc. For Pipes, Tanks Etc., Pts	5,653	202,676	35,856
3	9015 Survey, Hydrogr, Meteoro Etc. Inst; Rangef Etc., Pts	3,666	469,956	128,209
4	8471 Automatic Data Process Machines; Magn Reader Etc.	3,089	549,035	177,723
5	8479 Machines Etc. Having Individual Functions Nesoi, Pt	2,828	286,388	101,252
6	7304 Tubes, Pipes Etc., Seamless, Iron Nesoi & Steel	2,777	14,358	5,171
7	8517 Electric Apparatus For Line Telephony Etc., Parts	2,618	1,262,381	482,198
8	8708 Parts & Access For Motor Vehicles (head 8701-8705)	2,399	60,471	25,206
9	8207 Interchange Tools For Hand- Or Machine-tools, Bmpt	2,250	250,587	111,382
10	8411 Turbojets, Turbopropellers & Oth Gas Turbines, Pts	2,158	954,243	442,111
11	7307 Tube Or Pipe Fittings, Of Iron Or Steel	1,908	35,458	18,582
12	8413 Pumps For Liquids; Liquid Elevators; Parts Thereof	1,900	72,866	38,347
13	8544 Insulated Wire, Cable Etc.; Opt Sheath Fib Cables	1,804	80,712	44,744
14	8536 Electrical Apparatus For Switching Etc., Nov 1000 V	1,739	85,379	49,109
15	8414 Air Or Vac Pumps, Compr & Fans; Hoods & Fans; Pts	1,656	55,575	33,563
16	9801 Expts Of Repaired Impts; Impts Of Returned Expts	1,545	351,339	227,410
17	8473 Parts Etc. For Typewriters & Other Office Machines	1,480	232,664	157,177
18	8542 Electronic Integrated Circuits & Microassembl, Pts	1,412	192,373	136,236
19	8483 Transmission Shafts, Bearings, Gears Etc.; Parts	1,393	33,806	24,265
20	8703 Motor Cars & Vehicles For Transporting Persons	1,312	30,325	23,117

Rank	Commodity	SWT	Value	$/ton
21	2710 Oil (not Crude) From Petrol & Bitum Mineral Etc.	1,306	1,794	1,374
22	8409 Parts For Engines Of Heading 8407 Or 8408	1,254	39,987	31,878
23	8504 Elec Trans, Static Conv & Induct, Adp Pwr Supp, Pt	1,205	101,105	83,910
24	8421 Centrifuges; Filter Etc. Mach For Liq Or Gases; Pts	1,140	62,458	54,804
25	8412 Engines And Motors Nesoi, And Parts Thereof	1,133	31,864	28,115
26	4016 Articles Nesoi Of Unharded Vulcanized Rubber	1,041	16,873	16,214
27	9401 Seats (except Barber, Dental, Etc.), And Parts	1,036	36,960	35,669
28	9018 Medical, Surgical, Dental Or Vet Inst, No Elec, Pt	1,008	170,885	169,523
29	9026 Inst Etc. Measure Or Check Flow, Level Etc., Pts Etc.	993	126,258	127,142
30	8529 Parts For Television, Radio And Radar Apparatus	980	107,342	109,550
31	8466 Parts Etc. For Machine Tools Of Head 8456 To 8465	972	61,036	62,797
32	3901 Polymers Of Ethylene, In Primary Forms	963	2,424	2,517
33	3926 Articles Of Plastics (inc Polymers & Resins) Nesoi	888	22,577	25,427
34	3304 Beauty, Make-up & Skin-care Prep; Manicure Etc. Prp	865	17,752	20,517
35	8538 Parts For Elec Appar Etc. Of Head 8535, 8536 & 8537	825	28,562	34,601
36	9027 Inst Etc. For Physical Etc. Anal Etc.; Microtome; Pts	795	113,263	142,424
37	3602 Prepared Explosives Other Than Propellent Powders	762	32,723	42,950
38	9032 Automatic Regulating Or Control Instruments; Parts	737	168,190	228,212
39	8501 Electric Motors And Generators (no Sets)	707	16,523	23,368
40	7326 Articles Of Iron Or Steel, Nesoi	706	10,615	15,039
41	8803 Parts Of Balloons Etc., Aircraft, Spacecraft Etc.	668	252,995	378,798
42	7306 Tubes, Pipes & Hollow Profiles Nesoi, Iron & Steel	661	3,400	5,141
43	8525 Trans Appar For Radiotele Etc.; Tv Camera & Rec	612	137,582	224,965

Rank	Commodity	SWT	Value	$/ton
44	0302 Fish, Fresh Or Chilled (no Fillets Or Other Meat)	604	2,976	4,928
45	6203 Men's Or Boys' Suits, Ensembles Etc., Not Knit Etc.	592	9,169	15,492

Source: USA Trade Online, "The Trade Data," Online available: http://www.usatradeonline.gov, Accessed: May 2007.

Finally, Table 27 reveals that Japan, among Asian countries recorded steady air freight volumes And Taiwan began to transporting air freight in 2004. Japan's market-based air freight performance reached to 7,784 tons in 2004, and then it declined to 6,140 tons in 2006. So, its average growth rate was negative at -1.5 percent. IAH's air freight exports to Japan decreased by 8.5 percent between 2001 and 2006, while its air freight imports from Japan grew by 1.2 percent over the same time period, although there was a sharp decrease in 2006. Taiwan recorded its first market-based air freight traffic in 2004, and then its performance grew to 1,891 tons in 2006. However, its share in total IAH air freight tonnage was weak. These figures demonstrate that Asia was not a major IAH trade partner.

Table 27: Trans-Pacific Air Freight Performance with IAH (tons, %)

	Country	1990	2000	2001	2002	2003	2004	2005	2006	01-05
TOTAL	IAH Total	60,998	107,563	106,548	112,640	129,611	135,104	148,722	166,300	8.7
	Sub-total	6,071	7,895	6,631	7,381	7,803	8,147	7,867	8,031	3.9
	China	-	-	-	-	-	-	-	-	
	Hong Kong	-	-	-	-	-	-	-	-	
	Japan	4,299	7,895	6,631	7,381	7,803	7,884	7,102	6,140	-1.5
	Korea	89	-	-	-	-	-	-	-	
	Singapore	1,683	-	-	-	-	-	-	-	
	Taiwan	-	-	-	-	-	263	765	1,891	168.3
From IAH	Total	40,899	54,952	55,784	54,272	66,181	66,197	79,143	86,302	9.1
	Sub-total	5,508	2,563	2,114	1,956	2,105	2,072	1,907	2,498	3.4
	China	-	-	-	-	-	-	-	-	
	Hong Kong	-	-	-	-	-	-	-	-	
	Japan	3,737	2,563	2,114	1,956	2,105	2,003	1,723	1,353	-8.5
	Korea	89	-	-	-	-	-	-	-	
	Singapore	1,683	-	-	-	-	-	-	-	
	Taiwan	-	-	-	-	-	69	184	1,145	308.1
To IAH	Total	20,099	52,611	50,765	58,368	63,429	68,907	69,580	79,997	9.5
	Sub-total	562	5,332	4,516	5,425	5,698	6,075	5,960	5,534	4.1
	China	-	-	-	-	-	-	-	-	
	Hong Kong	-	-	-	-	-	-	-	-	
	Japan	562	5,332	4,516	5,425	5,698	5,881	5,379	4,788	1.2
	South Korea	-	-	-	-	-	-	-	-	
	Singapore	-	-	-	-	-	-	-	-	
	Taiwan	-	-	-	-	-	194	581	746	96.1

Source: BTS website, Accessed: June 2007.

Note: This is a market-based air freight performance data. Segment-based air freight performance is also similar to market-based air freight performance because Japan's air freight performance each year was performed by scheduled passenger/cargo combination service.

CHAPTER 3. ECONOMIC IMPACTS OF AIR CARGO

Role of the Air Cargo Industry

Air transport has become particularly important in today's expanding global economy for the movement of high-value goods such as electronics, computer components, precision equipment, medical supplies, auto parts, and perishables. Air cargo operations allow fast, frequent, and predictable transit as an increasing number of companies out-source manufactures to remote locations of the world. Decreasing product cycles for high-value, high-technology goods have made fast delivery to market essential.[4] In addition, local industries have become global traders and consumers can enjoy goods from any part of the world.

Nations with efficient air cargo capability have competitive trade and production advantages over those without such capability in the new fast product cycle era. With the increasing use of air cargo as a means of transporting goods that were once transported by ocean vessel, many argue that the international air transportation system is quickly becoming the backbone of the global economy.[5] Air shipments move 40 percent of the value of world trade, but only 1 percent of the total weight.[6] Air cargo is a $55 billion business, accounting for 12 percent of industry revenues in 2006. But more importantly, its role in the global economy is critical because 35 percent of the value of goods ($3.25 trillion) traded internationally fly on aircraft.[7]

Main Players in the Air Cargo Industry

Shippers

Shippers are defined as retailers and manufacturers of goods that require shipping[8] or as the person or company who is usually the supplier or owner of commodities shipped.[9] Therefore, shippers constitute the initial link in the air cargo chain. Their role is to set in motion the domestic or international shipping process. This function may be performed by the manufacturer, the holder of the merchandise, or the import/export company. When performed by the manufacturer, an additional objective is to focus on their core business and increasingly sub-contract shipping, distribution, assembly lines, delivery, and back-up functions to other vendors.[10]

In order to achieve their objectives, shippers require value-added transport and logistic services from the manufacturer to the consumer. They must be able to assure guaranteed, reliable service and continuous feedback throughout the air logistics chain. It is important for shippers to have the capability to monitor the progress of goods until they are delivered to the customer. Inter-modality and efficient logistics services are essential for industry growth and development.[11]

Forwarders

According to the U.S. government's Export Portal, an international freight forwarder is an agent for the exporter in moving cargo to an overseas destination. These agents are familiar with the import rules and regulations of foreign countries, the export regulations of the U.S. government, the methods of shipping, and the documents related to foreign trade. Export freight forwarders

are licensed by the International Air Transport Association (IATA) to handle air freight and the Federal Maritime Commission to handle ocean freight.[12]

The term 'forwarder' includes all functions dedicated to the execution of shipping, but excludes airline activities. Air freight forwarders provide a service to freight generators, and consumers (shippers), and importers. Initially, forwarding involved receiving a consignment of freight on behalf of the shipper, arranging its routing, transportation, handling, and documentation to final receiver in some cases or to a foreign airport in others.[13]

A forwarder's business development is governed by the need to provide value-added services required by the reorientation of the manufacturers on their core business.[14] Air freight forwarders range in size from large companies with multi-national networks offering global coverage either directly or through agents, to the small specialist forwarders handling a particular type of shipment.[15]

Airlines

An airline provides air transport services for passengers or freight, generally with a recognized operating certificate or license. Airlines lease or own their aircraft to provide these services and may form partnerships or alliances with other airlines for mutual benefit. Full-service international airlines operate hundreds of aircraft. Their services can be categorized as being inter-continental, intra-continental, or domestic and may be operated as scheduled services or charters.[16] In terms of products and destinations, cargo airlines attempt to maximize their profit by positioning their flights within the highest yield markets. On the other hand, combination carriers aim to fill hold space through effective air cargo pricing policies.[17]

Air Integrators

Companies operating in the express service market are often fully integrated, meaning they provide not only the air service, but also the sorting and ground transportation that allows them to offer door-to-door services[18]. Integrators usually provide their own local trucking and handling/warehousing facilities, often through an airport terminal dedicated to their use and aircraft.[19] The names of worldwide integrated express service providers are well known including Federal Express (FedEx) and United Parcel Service (UPS).

Integrators provide tailor-made, door-to-door express services with guaranteed delivery times. They integrate both forwarder and airline functions within the air-cargo chain. Their main objective is centered upon achieving shipper satisfaction by limiting the length of time assets are immobilized. In addition, the availability of efficient and simplified customs procedures is also important.[20]

Airports

Airports generally act as landlords and infrastructure providers, charging landing fees and parking fees to airlines and rent to service companies for passenger reception terminals, retail and catering outlet offices, cargo transit sheds, and aircraft maintenance workshops.[21] As

transportation hubs, their facilities include carrier terminals, freight forwarder hubs, and regional distribution centers.[22]

More importantly, airports contribute to a region's economic development and provide links to world markets.[23] An airport has two main economic benefits to its local community. One is its obvious transportation use in moving people and goods long distances and the second is its impact on regional employment and purchases from suppliers to support its operations.[24]

Measurement of Economic Impacts of Airports

Airports can make an important contribution to a state's economy by generating employment and other economic activity, not only at the airport and in the surrounding community, but also for the country as a whole.[25] Therefore, airports are an essential part of the regional economic infrastructure and it is important that the growth of airports is seen as an integral part of national regional economic development strategies. Growth of air service access can enhance the growth potential of a region, which in turn will increase the demand for air travel, creating a virtuous circle of growth.[26]

Therefore, communities are eager to extend their local airport's capabilities to realize competitive trade and production advantages over those without such capabilities. Economic analyses of airport projects are becoming an increasingly important component of governmental investment decisions. The economic impacts of an airport are assessed by looking at the full extent of an airport's impact on the local, regional, and national economy.[27] Accordingly, economic impact assessments can be designed to collect information on a wide range of economic activities taking place at the airport, in the surrounding region, or even throughout the state.

Airport economic impacts typically are classified as direct, indirect, and induced effects, variously expressed in terms of jobs, wages, value added, business output, and taxes generated. Direct impacts are generated by economic activities carried out at the airport by airlines, airport management, fixed-base operators, and other tenants with a direct involvement in aviation. Employing labor, purchasing locally produced goods and services, and contracting for airport construction and capital improvements are examples of airport activities that generate direct impacts. The distinguishing feature of a direct impact is that it is an immediate consequence of airport economic activity.[28]

Indirect airport impacts are those associated with economic activities that supply on-airport and off-airport business activities such as hotels, restaurants, and travel agencies. Induced impacts are the result of successive rounds of spending in the local community by those employed at airports and their suppliers.[29] Direct, indirect, and induced employment often constitutes a major segment of a region's or a state's economy.[30]

Input-output models are generally applied to calculate the multiplier effects of these combined employment/expenditure impacts. An economic impact assessment can reveal benefits from tourism and various related activities to the economy concerned. Economic activities attributable to the tourism industry that are highly dependent on air transport services can be accounted for as

catalytic demand effects when applying an extended approach of an economic impact assessment.

Commercial Aviation and the American Economy[31]

The Campbell-Hill Aviation Group examined the relationship between commercial aviation and its economic impacts in 2006. The study measured direct impacts of airline operations and supporting services for aircraft, engines, and parts manufacturing. Air-visitor travel and other trip-related expenditures constituted an indirect impact that results from air transport activity.

The U.S. civil aviation sector was collectively responsible for $1.37 trillion of national output in 2004, supporting 12.3 million U.S. employees and $418 billion in personal earnings. In the analysis, commercial aviation accounted for the majority of this impact with $1.2 trillion in output, $380 billion in earnings and 11.4 million jobs.

The national economy is highly dependent on commercial aviation, which, in 2004, was directly or indirectly responsible for 5.8 percent of GDP, 5.0 percent of personal earnings and 8.8 percent of national employment. Specifically, the direct impact of commercial air transportation and related industries was estimated at $247 billion in GDP, $72 billion in earnings and over a million jobs.

Commercial air transportation was the primary source of direct impacts in 2004, with $130 billion of output, followed by aircraft and related manufacturing at $75 billion, air express couriers at $24 billion, and air transportation support goods and services at $18 billion. The indirect impact of expenditures by commercial air travelers created an additional $191 billion of gross output, $67 billion of earnings, and 3.3 million jobs. The lodging and food industries accounted for more than one-half of the total impact.

The direct and indirect impacts of commercial aviation generated additional "induced" impacts as industry revenues and employee earnings were used to purchase goods and services from other industries. The induced impacts of commercial aviation in 2004 were estimated at $808 billion in GDP, $241 billion in earnings, and 7.0 million jobs. Most of these induced impacts were attributed to the service sector, with the manufacturing and trade sectors also significantly impacted. The service sector accounted for nearly one-half of the $1.25 trillion in total national impact and supported by both direct and indirect impact industries through travel and tourism services.

The analysis extended the national impact of commercial aviation to every congressional district and the District of Columbia. California was the top state, with $203 billion in GDP, followed by Texas, Florida, Georgia and New York. The top congressional districts were either major tourist destinations (Hawaii and Las Vegas area) or top aviation-manufacturing centers (western Washington), although every district had a significant level of impact.

The Economic Impact of General Aviation in Texas[32]

In 2006, Wilbur Smith Associates conducted an economic impact analysis for general aviation in Texas under the authority of the Texas Department of Transportation to better understand the relationship between general aviation the statewide economy.

The economic benefits produced were determined by using actual survey data and input-output model estimates of purchases and sales between the various sectors of the Texas economy. The model incorporated multipliers and tables of data specific to Texas, and required first-round impact estimates for three separate components of the economy:

- Employment based on full-time equivalent positions. For example, two part-time employees were assumed to equal one full-time employee;

- Payrolls based on the annual salaries and benefits paid to employees; and

- Output derived from the sum of average annual capital expenditures, operating expenses, and payrolls.

The model also included impact categories to assess the economic benefits associated with on-airport tenants and general aviation visitors:

- First-round impacts included both direct and indirect impacts. Direct impacts are the benefits associated with businesses located at the airport, which are directly related to the provision of general aviation services. Direct impacts include the employment, payrolls, and spending of businesses such as fixed-base operators (FBOs), flight schools, government entities, and others.

  Indirect impacts occur as a result of air travel, but generally take place off-airport. These impacts are attributed to the expenditures of visitors who arrive in Texas by air. Visitor expenditures support employment and payroll in service-related industries such as lodging, food and beverage, retail, and entertainment. Visitor spending for aviation related goods and services are not accounted for in the visitor expenses; instead, it is included in the appropriate tenant's gross sales.

For this study, all first-round impacts were identified through survey efforts as well as interviews with various airport managers throughout the Texas system.

- Secondary impacts consist primarily of induced impacts. Induced impacts are the benefits resulting from the recirculation of direct and indirect impacts within the economy. This recirculation is typically referred to as the multiplier effect. For example, as an airport employee spends his or her salary for housing, food, and services, those expenditures circulate through the economy resulting in increased spending, payroll, and employment throughout Texas.

  Because secondary impacts are not as easily quantified as first-round impacts, a reliable method of estimating the induced impacts must be applied. For this study, they used the

Impact Analysis for Planning (IMPLAN) model to measure the multiplier effect and determine secondary impacts. The model contains a detailed database of economic multipliers used to estimate the induced impacts associated with the first-round on-airport and visitor spending.

For each round of spending beyond the first round, a share of the re-spending occurs outside of the area. This is considered economic leakage, and therefore is not included in the statewide multiplier.

Employment Impacts

It was estimated that first-round tenant employment impacts attributed to general aviation totaled 29,700 jobs. This figure did not include employment impacts associated with the non-aviation businesses that are located at various airports throughout the system. As a result of first-round tenant employment, the multiplier effect created additional secondary employment. Secondary employment added nearly 24,300 additional full-time positions to the Texas workforce; thus, the total (first round and secondary) tenant employment contribution of the Texas system of airports to the state economy was approximately 54,000 full-time positions.

In addition, visitor-related jobs were calculated by first estimating the number of general aviation visitors arriving in Texas, then identifying typical spending trends. The first-round employment associated with general aviation visitors impacts a variety sectors; however, the majority of these jobs are attributed to the lodging, food and drink, recreation and entertainment, and retail sectors. The first- round employment supported by general aviation visitors was estimated to be approximately 5,900 full-time positions in 2005, while the secondary impacts attributed to visitor expenditures resulted in more than 2,100 positions. The total employment impact of general aviation visitors resulted in approximately 8,000 full-time positions. These jobs are in addition to the tenant employment aforementioned.

Payroll Impacts

First-round payroll impacts include the salary and benefits paid to workers employed at visitor related businesses and other service industries that are typically utilized by general aviation visitors. The statewide first-round payroll impacts related to general aviation visitors were estimated at more than $123 million and more than $84 million in additional payrolls were attributable to secondary impacts. This resulted in a total general aviation visitor payroll of over $207 million.

Output Impacts

The estimated total first-round output of on-airport tenants was more than $4.4 billion, while secondary impacts were estimated to account for nearly $4.0 billion. Combined, the first-round and secondary output benefits of airport tenants in the Texas system were estimated to be approximately $8.4 billion.

The first-round output of general aviation visitors is typically comprised of expenditures for food and beverages, lodging, retail, entertainment, and other related services. The total first-round

output of general aviation visitors was estimated to be approximately $201 million, and the secondary output added nearly $169 million. Hence, visitors arriving in Texas via general aviation aircraft were responsible for more than $370 million in output in 2005.

As a result, statewide first-round total output was estimated at more than $4.6 billion, while secondary impacts were estimated at approximately $4.1 billion, totaling $8.7 billion

In addition to the quantitative benefits presented in the preceding sections of this report, there are many qualitative benefits that contribute to the overall impact of the airport system. These qualitative benefits enhance the quality of life, health, welfare, and safety of the citizens of Texas.

Economic Impact Study of Houston Airport System[33]

The Houston Airport System (HAS) includes George Bush International Airport (IAH), William P. Hobby Airport (HOU), and Ellington Field (EFD). These airports provide passenger, cargo and general aviation services to the Houston metropolitan area generating significant economic impacts through its aviation activities, as well as providing significant developmental and other qualitative benefits.

These combined aviation activities at the three airports generate employment, payrolls and sales for local residents and businesses. The city of Houston conducted an economic impact study based on calendar year 2003 statistics. This study estimated the level of local economic the following types of impacts:

- Direct impacts from transportation and supporting activities (including commercial and non-commercial);
- Direct impacts from capital expenditures at the airports;
- Indirect impacts from air visitor expenditures; and
- Induced impacts derived from direct impacts

Direct transportation-based impacts were measured in terms of the employment, payrolls and sales (or output for non-commercial operations) that directly result from airport activities including passenger transits, cargo transfers, and aircraft operations, supporting industrial or military operations. The impacts of capital investment in the airports were measured separately in order to capture the benefits from expanding infrastructure supported by airport activities. The indirect impacts of Houston visitors who travel by air and make expenditures in the local economy were measured in terms of employment, payroll and sales for the travel, tourism and related industries. Finally, induced impacts capture the secondary impacts to the economy as direct sales and payrolls produced "multiplier" effects.

The methodologies used to estimate these impacts varied by type of activity and airport, but were based on the following general procedures:

- Direct employment dependent on airport activities was measured through a survey of airport-related companies with secondary sources used for non-respondents;

- Direct payroll and sales impacts were based on U.S. government sources (or by survey for non-industrial activities);
- Direct capital expenditure impacts were based on HAS budget data and industrial profiles for the affected construction and related service sectors;
- Indirect visitor expenditure impacts were estimated on the basis of airport passenger data, state of Texas tourism statistics, and industrial statistics for affected industries; and
- Induced impacts were projected by using U.S. government multipliers for the Houston metropolitan area on an industry-specific basis.

The result showed that the HAS airports generated over $24 billion in total impact for the Houston economy, including $8.9 billion of direct impacts, $2.0 billion on indirect impacts, and $13.3 billion of induced impacts. Direct employment impacts exceed 37,000 jobs, yielding $2.5 billion in payroll, while indirect employment exceeds 26,000 jobs and $730 million in payroll.

Specifically, the bulk of the direct impact occurred for commercial airlines and other aircraft operators, which generated over 22,000 jobs, $1.7 billion in payrolls, and $6.4 billion of output. Government users and support agencies were the next largest impact sector, followed by passenger ground transportation and airport and aircraft services. According to the result, air cargo service generated 1,493 employees, $145 million in payroll, and $405 million of output.

The result of the distribution of direct impacts by airport showed that Bush Intercontinental Airport generated over $7 billion of output impacts including $1.9 billion in payrolls and over 28,000 jobs. Houston Hobby was responsible for over 6,000 jobs, $409 million in payrolls and $1.5 billion of local output. Finally, Ellington Field appeared to support over 1,400 jobs, but has smaller payroll ($73 million) and output ($134 million) based on the high dependence on government activities.

The impact of airport development on the local economy was measured separately to reflect the level of capital investment stimulated by airport activities. Direct capital expenditure impacts on Houston's economy were estimated at over $201 million of annual revenues, $76 million in payrolls, and over 1,000 jobs. Bush Intercontinental accounts for 90% of this total, with $180 million in output, $68 million of payrolls, and 968 jobs. IAH was followed by Houston Hobby with a direct impact of 58 jobs, $5 million in payrolls and over $12 million in local output, and Ellington Field's 44 jobs that generated $3 million in payrolls and over $8 million in output.

The indirect visitor expenditure impacts were estimated at over $2 billion of annual revenues, $730 million in payroll, and over 26,000 jobs. Bush Intercontinental accounts for over 75% of this total, with over $1.5 billion in output, $544 million of payroll, and nearly 20,000 jobs. On the other hand, Houston Hobby had a direct impact of 6,650 jobs, $183 million in payrolls and over $500 million in local output. Ellington Field's 92 jobs generated $3 million in payrolls and $7 million in output.

CHAPTER 4. POTENTIAL OF AIR FREIGHT AND ITS POLICY IMPLICATIONS FOR TEXAS

Growth in worldwide air freight traffic slowed to 2.0 percent in 2005, following a 12.0 percent increase in 2004. Major contributors to the slowdown were weakening global economies, a slowdown in trade, and rising jet fuel prices which compelled air freight operators to pass along some of the burden to customers through the imposition of fuel surcharges. However, according to a number of forecasts, covering different time periods and performed by a variety of air transport organizations, aircraft manufacturers and consultants, international air cargo traffic volumes will continue to experience rapid future growth rates (see Table 28).

The International Air Transport Association (IATA) estimated that international air freight (measured in tons) would grow by 6.3 percent annually between 2005 and 2009. This predicted growth rate was higher than the real international air-freight growth rate of 2.0 percent in 2005. The International Civil Aviation Organization (ICAO) forecast a 5.5 percent average annual growth rate for worldwide air freight between 2002 and 2015.

The Airports Council International (ACI) estimated a 5.4 percent average annual growth rate over the period of 2006-2025. Freight operations (also measured in tons) are expected to grow faster than passenger operations: total 2005 air freight tonnage is expected to almost triple, reaching about 214 million tons by 2025, up from roughly 76 million tons in 2005.

MergeGlobal Inc.[34] estimated that global air freight traffic most likely would grow moderately over the time period of 2005 to 2010. According to MGI, there are three main drivers of rising freight demand: sustained economic growth in the main consuming economies of North America, Europe, and Japan; the progressive off-shoring of industrial goods production from North America and Europe to Asia; and, persistent congestion and delay problems in the containerized ocean transport system which will lead to both planned and emergency traffic shifts from seaborne freight to air freight. With regard to those drivers, MGI predicted a compound average growth rate of 6.4 percent from 2006 to 2010, more than twice the rate achieved in the 2000-2005 period.

Boeing and Airbus, the largest aircraft manufacturers, also provided long-term, air freight forecasts. Boeing estimated that air cargo will grow by 6.2 percent annually over the time period of 2005 to 2025 in revenue ton-kilometers (RTKs[35]). According to Boeing, the non-U.S. airline market share of air freight traffic will continue to expand and reach 76 percent of total air freight RTKs, up from slightly less than 73 percent recorded in 2005. Non-U.S. airlines will continue to dominate long-haul international routes, representing slightly more than 68 percent of the world traffic by 2025, unchanged from 2005. Traffic carried by U.S. airlines will also grow during the forecast period as U.S. domiciled express carriers increase international service. U.S. carrier domestic traffic will fall from 12.4 percent to 7.4 percent by 2025, reflecting slower growth rates and the emergence of domestic markets such as China and India. With regard to these expected changes, Boeing forecast that worldwide traffic will more than triple between 2005 and 2025, up from 178.1 billion RTKs in 2005 to more than 582.8 billion RTKs by 2025. Boeing believes that sustained economic growth, along with decreasing yields, will contribute significantly to the growth of the air-freight industry.

According to Airbus, the export of more time-sensitive, high-value and high-technology goods has grown fastest in terms of globally traded commodities, largely explaining the rapid growth of international air freight. Airbus forecast that air freight, expressed in terms of freight ton-kilometers (FTKs[36]), will grow at a 6.0 percent average annual rate over the 2006-2025 period.

Table 28: Air Freight Forecasts

Region	Market	Forecast Unit	Period	AAGR (%)
IATA[a]	International	Freight tons	2005-2009	6.3
ICAO[a]	World	Freight ton-kilometers (FTK)	2002-2015	5.5
ACI[b]	World	Freight tons	2006-2025	5.4
MGI[c]	World	Metric tons	2005-2010	6.4[1]
Boeing[d]	World	Air Freight Revenue Ton-Kilometers (RTK)	2005-2025	6.2
Airbus[e]	World	Freight ton-kilometers (FTK)	2005-2025	6.0

Source: a: IATA, World Air Transport Statistics Volume 1: World Air Transport Digest, 50th Edition, published 2006, p.52.
b: ACI, Global Traffic Forecast 2006-2025: Executive Summary, edition 2007.
c. MGI, 2005 World Air Freight Forecast, Aug. 2006.
d: Boeing, World Air Cargo Forecast 2006-2007, Sep. 2006.
e: Airbus, Global Market Forecast: The future of flying 2006-2025, Nov. 2005.
Note: 1: Compound average growth rate between 2006 and 2010.

Regional Air Freight Forecast

The IATA also provided forecasts of route-based global air freight over the 2005-2009 period. Among various routes, IATA predicted that Middle East-Asia Pacific routes would be the fastest-growing region for the period of 2005-2009 (see Table 29), followed by "within Asia/Pacific" as the second-fastest growing region. IATA estimated that the Middle East-Asia/Pacific market would grow an average annual 8.8 percent and the within Asia/Pacific region would increase by 8.5 percent annually.

Two regions, Trans-Pacific and Europe-Asia/Pacific, would expand more slowly than the world average of 6.3 percent. According to IATA, more mature regions such as North Atlantic and within Europe would experience the lowest average annual increases of 4.1 to 4.6 percent.

Table 29: IATA's Global Air Freight Growth Forecast 2005-2009 by Routes (%)

Region	2005	2006	2007	2008	2009	Average
North Atlantic	5.1	4.6	4.5	4.6	4.4	4.6
Trans-Pacific	6.6	7.1	5.6	5.4	5.2	6.0
Europe-Asia/Pacific	6.9	6.1	5.3	5.1	5.3	5.7
Europe-Middle East	7.0	5.1	4.9	4.5	4.0	5.1
Europe-Africa	5.0	4.5	4.6	4.3	4.2	4.5
Middle East – Asia/Pacific	13.7	8.6	7.3	7.5	7.0	8.8
Within Asia/Pacific	8.5	8.7	8.1	8.7	8.4	8.5
Within Europe	5.1	3.8	3.7	3.8	3.9	4.1
Within Latin America	3.0	2.8	6.4	7.0	5.7	5.0
Total	6.8	6.3	5.7	5.8	5.7	6.3

Source: IATA, World Air Transport Statistics Volume 1: World Air Transport Digest, 50th Edition, published 2006, p.52.

ACI also projected air freight growth rates by region (see Table 30). According to ACI's forecast, Asia/Pacific region is expected to experience the fastest average annual growth rate of 6.5 percent over the 2005-2025 period. High growth in manufacturing in Asian countries, such as China and India, is expected to drive this rapid growth, but air-freight flows will remain unbalanced with most freight flowing outbound from Asia. And international freight flows will also benefit as combination aircraft belly-capacity grows and as Middle Eastern air carriers develop their hub operations over the forecast period.

On the other hand, a mature market such as freight in North America is likely to grow more slowly than in the other geographic regions. Its average annual growth rate is forecast to be 4.4 percent over the next two decades. Consequently, North America, the largest region in the world with a 35-percent share of total freight volume, is expected to be surpassed by Asia by the end of the forecast period. ACI estimated that the two regions collectively are estimated to account for about 75 percent of all freight volume by 2025.

Table 30: ACI's Total Freight Growth Rates Forecast by Region 2005-2025 (%)

Region	2006	2007	2008	2009	2010	2015	2025	05-	05-
Africa	11.4	6.9	6.1	5.7	5.1	5.0	4.8	5.4	7.0
Asia/Pacific	6.6	7.4	7.4	7.3	7.0	6.4	6.3	6.5	7.1
Europe	3.6	6.6	5.6	4.9	5.7	4.8	4.6	4.8	5.3
Latin America/Caribbean	-1.6	5.8	5.9	5.8	5.3	5.3	5.1	4.9	4.2
Middle East	10.6	6.8	7.4	7.5	6.9	6.4	3.6	5.3	7.9
North America	6.6	5.2	4.9	4.6	4.5	4.3	4.0	4.4	5.1
Total	5.8	6.4	6.1	5.8	5.8	5.3	5.1	5.4	6.0

Source: ACI, Global Traffic Forecast 2005-2025, Executive Summary, Edition 2007.

Table 31 shows Boeing's regional forecast of future air freight. The Intra-Asia regional market is expected to grow the fastest of all markets, averaging 8.6 percent growth per year, whereas the Asia–North America and Europe-Asia markets will expand at average annual rates of 7.1 percent and 6.9 percent, respectively. China's domestic market will be the fastest-growing contiguous market in the world, averaging 10.8 percent growth per year for the forecast period. Market shares, consequently, will continue to change as a result of varying regional growth rates. Although it is estimated grow 10.8 percent per year over the next 20 years, China's domestic market will still possess a relatively small market share, given its current size and the market's relatively short average trip distance. Overall, the share of world air trade connected to Asia's markets, including the domestic markets of China and Japan and all international markets, will increase from 50.8 percent in 2005 to 63.3 percent by 2025.

The mature markets of North America and Intra-Europe will grow slower than the world average annual rates. For North America, Boeing projected a 3.9 percent rate of growth during the 10-year forecast period and a 3.8 percent growth rate during the 20-year period through 2025. On the other hand, Intra-Europe air cargo is expected to continue to grow at a relatively strong average annual growth rate of about percent. Boeing forecasts that both scheduled combination and all

air-cargo airlines will experience more moderate growth, averaging 2 percent to 4 percent per year during the forecast period.

The Europe-North America market's baseline average annual air-cargo growth, for the forecast period of 2005 through 2025, is 5.1 percent eastbound and 5.6 percent westbound, resulting in an overall average annual market growth rate of 5.4 percent. According to Boeing, the low-growth scenarios amount to average annual growth rates of 4.0 percent eastbound and 4.3 percent westbound. The high-growth scenarios envisage average annual growth rates of 6.3 percent eastbound and 6.9 percent westbound.

Among regions, air freight trade lanes linking Europe–North America (at 5.4-percent growth), Europe-Africa (at 5.3-percent growth), and Europe–Middle East (at 4.3-percent growth) are projected to lag behind the worldwide average annual growth rate. Europe–Southwest Asia (at 6.2-percent growth) will slightly exceed the world average.

Table 31: Boeing's Regional Air Freight Market Forecast 2005-2025 (%)

Region	Growth Rate	Region	Growth Rate
Domestic China	10.8	Latin America-Europe	5.6
Intra-Asia	8.6	Europe-North America	5.4
Asia-North America	7.1	Europe-Africa	5.3
Europe-Asia	6.9	Intra-Europe	5.0
Europe-Southwest Asia	6.2	Europe-Middle East	4.3
Latin America-North America	5.6	North America	3.8

Source: Boeing, World Air Cargo Forecast 2006/2007, Sep. 2006.

Airbus also provided an air freight market forecast (see Table 32). International traffic is expected to grow by 6.7 percent per year over the next 10 years and by 6.1 percent over the next 20 years[37]. Among the top traffic flows, domestic China air freight traffic is expected to expand at 12.6 percent per year between 2006-2015 and 10.9 percent per year between 2006-2025. China to North America and China to Europe are expected to grow 9.8 percent and 9.1 percent, respectively, between 2006-2025. Consequently, these two markets are forecast to expand their share of world's FTKs to 14.6 percent and 7.8 percent.

The U.S. domestic market, still the largest with 11.9-percent share of world FTKs, is also the most mature; it will grow at a sustained rate of only 3.3 percent per year and will be the third-largest market in 2025, with a 7.3-percent share of world FTKs.

Table 32: Top 10 Air Freight Markets and Growth Rate Forecast by Airbus (%)

Region	2006-2015	2016-2025	2006-2025	Share of World FTKs in 2025
China-North America	11.6	8.1	9.8	14.6
China-Europe	10.4	7.8	9.1	7.8
Domestic US	3.5	3.1	3.3	7.3
Domestic China	12.6	9.1	10.9	5.1
Asia-North America	6.6	4.4	5.5	4.9
Europe-North America	3.8	3.6	3.7	4.0
Asia-Europe	7.2	4.3	5.7	3.8
North America-Europe	3.4	3.6	3.5	3.1
Europe-China	9.2	6.5	7.9	3.1
North America-Asia	5.4	4.1	4.8	2.6

Source: Airbus, Global Market Forecast: the future of flying 2006-2025, Nov. 2006.

Policy Implications for Texas

Air Freight Trade Imbalance

Air freight trade flows have an important impact on aircraft routings and air cargo economics. In comparison to passenger travel, where outbound and inbound traffic flows are fairly equal, air freight typically experiences directional imbalances. The imbalance in air freight traffic between Texas and Asian countries is significant.

For worldwide trade, Texas experienced 2005 air freight exports of 204,000 tons and imports of 252,000 tons, for a 1-to-1.2 ratio. However, a greater imbalance existed in air freight trade between Texas and major Asian countries with Texas exports of 66,000 tons and imports of 140,000 tons, for a 1-to-2.1 ratio. DFW's air freight trade imbalance was similar to that of Texas as a whole. This means that every aircraft flight out of Asia to Texas is full, but on average, only half full on their westbound flights. Moreover, this imbalance is growing over the time.

A significant and expanding trade imbalance between Texas and Asian countries poses challenges for the international air cargo industry because its profitability has deteriorated in recent years. Trans-Pacific air carriers incur round-trip costs, but revenues are predominantly generated on eastbound trips[38].

Airports can also be affected if they lose their attraction as best-routing origin/destinations as international air cargo carriers devise strategies to minimize the imbalance problem. For example, some carriers may decide to cancel round-trip flights with relatively empty backhauls and, instead, continue flying east from Asia to North America to Europe and back to Asia in an effort to avoid low load factors. And since the radius of competitiveness for ground transportation is growing, shippers are increasingly optimizing supply chains to rely on cheaper ground and seaborne shipments. Therefore, airports need to devise their own strategies to figure out as to how best to position themselves competitively to market circumstances.

Capacity Control and Maximization of Economic Impacts

Recent growth in air freight volumes is driving development of air freight facilities at both DFW and IAH. As discussed in the second chapter, Trammell Crow opened a newly built 35-acre cargo center, comprised of 395,000 sq. ft. of air cargo, logistics, freight forwarding, and warehouse space. An additional 350,000 sq. ft. of ramp space, 118,000 sq. ft. of warehouse space and 275,000 sq. ft. of logistics space was recently completed. IAH also opened a $140-million cargo facility that attracted UPS and FedEx to 500,000 sq. ft. of warehouse space in 2003. And Continental Airlines invested $30 million in a new facility to handle Asian and European traffic.

These investments at both DFW and IAH were undertaken to attract new domestic and international air-cargo carriers. DFW's strategic plan[39] is to encourage cargo carriers, who currently operate at DFW, to serve new international markets by extending flights to/from DFW. DFW is especially trying to encourage new or additional flights from/to China. IAH also attracted Korean Airlines in 2007, and Jade Air Cargo launched flights from China in 2007. Air Bridge Cargo inaugurated in twice a week service from its Siberian hub in Krasnoyarsk.[40]

From the point of view of an individual airport, it is natural to provide more space and facilities to attract as many air carriers as possible to its marketplace and to open new routes to those markets where air-freight demand has the greatest potential for growth. However, two points should be recognized before an airport development plan is implemented. First, potential problems associated with overcapacity should be considered. Chronic low returns on investments have not driven air cargo capacity down to its equilibrium level, because so much space is still available in the bellies of passenger aircraft.[41] Although all cargo aircraft capacity is growing faster that passenger aircraft, cargo hauled in the bellies of passenger aircraft still made up 41.2 percent of total Texas air freight capacity: it accounted for 26.1 percent of DFW's air freight capacity and 72.1 percent of IAH's air freight capacity in 2006.

Hence, a large portion of the capacity available at Texas airports is driven by the demands of other markets, meaning that supply and demand will remain difficult to balance. Determining whether cargo facility and space expansion is the best alternative for handling air freight should be carefully evaluated.

Moreover, DFW and IAH are located within three hours of highway travel to one another. Currently, DFW has been able to attract more Asia-oriented air freight than IAH. DFW's trans-Pacific air freight share of total international air freight reached to 71.9 percent in 2006. IAH's trans-Pacific share amounted to less than 5 percent of its total. Instead, IAH experienced higher shares in both Europe and Latin America air cargo traffic. These air freight trends may mean that DFW has planned more initiatives for Asian routes, while IAH demonstrates more strength on European and Latin American routes.

Conclusion and Further Study

A robust global economy led to a steady increase in world international trade, which, in turn, has stimulated rapid growth in air freight demand around the world. This growth in demand is expected to continue because 80 percent of traded goods will cross international borders in 2020. The growth in air freight on trans-Pacific routes linking U.S. origins and destinations with those

of China, Japan, and Korea has grown over 200 percent during the same period that high-tech manufacturers and other time-sensitive shippers were locating to sites accessible to major airports to transport telecommunications equipment, information technology, medical equipment, pharmaceuticals, software, and the like.

These economic and air freight transport trends are evident in the United States, Texas, and more specifically at the DFW and IAH airports. U.S. air freight volumes grew by 5.8 percent in market-based measurement and by 5.4 percent in segment-based measurement, which were greater than U.S. GDP growth over the 2001-2005 period. China, Hong-Kong, Japan, Korea, and Taiwan experienced growth in air freight traffic nearly 1.5 times greater than U.S. average air freight growth over the 2001-2005 period. As a result, their share in the U.S. total market-based air freight traffic increased to 33.5 percent in 2005, up from 31.1 percent in 2001. Similarly, their share of total U.S. segment-based air freight performance increased from 31.1 percent in 2001 to 33.5 percent in 2005.

For our state's air freight performance, this study found that the average annual growth rate of Texas market-based air freight was 11.3 percent between 2001 and 2005 or 3.6 times larger than that of segment-based air freight at 3.1 percent. Texas recorded a 24.3-percent average annual growth rate with six major Asian countries between 2001 and 2005. This average growth rate was more than two times higher than the state's average annual growth rate of 11.3 percent. Among them, China, Hong-Kong, Singapore, Korea, and Taiwan recorded much higher growth rates at 118.6 percent, 32.1 percent, 50.9 percent, 21.4 percent and 22.8 percent, respectively. Only Japan experienced a negative average annual growth rate, at -1.2 percent, in total air-freight performance.

Under these circumstances, the search for Asian and U.S. air cargo hubs is turning into a high-stakes battle for the future of air-freight flows across the Pacific Ocean driving substantial investments in airports and their surrounding regions. However, this rapid growth in trade with Asia generates its own set of problems in terms of directional air freight traffic imbalances and the adverse consequences of overinvestment in airport facilities.

ENDNOTES

[1] Source: BTS website, Accessed: January 2007 (http://www.transtats.bts.gov/glossary.asp).

[2] According to BTS, charter flight is a commercial passenger vehicle trip not scheduled, but arranged. The charter contact normally commits the carrier to furnish the agreed to transportation service at a specified time between designated locations.

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[35] RTK: A metric ton of revenue load carried one kilometer. Ton-kilometers performed equals the sum of the products obtained by multiplying the total number of tons of each category of revenue load carried on each sector of a flight by airport-to-airport distance. (http://europa.eu.int/estatref/info/sdds/en/avia/avia_airtransp_glossary_v6.pdf)

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