

STUDY ON THE AIR CARGO HUB NETWORKS OF THE INCHEON INTERNATIONAL AIRPORT

Kyungwoo Kang
Professor
Department of Transportation Engineering
Hanyang University
1271 Sa-1 Dong Ansan,
Korea, 425-791
Fax: +82-31- 400 -6290

E-mail: kyungwoo@hanyang.ac.kr

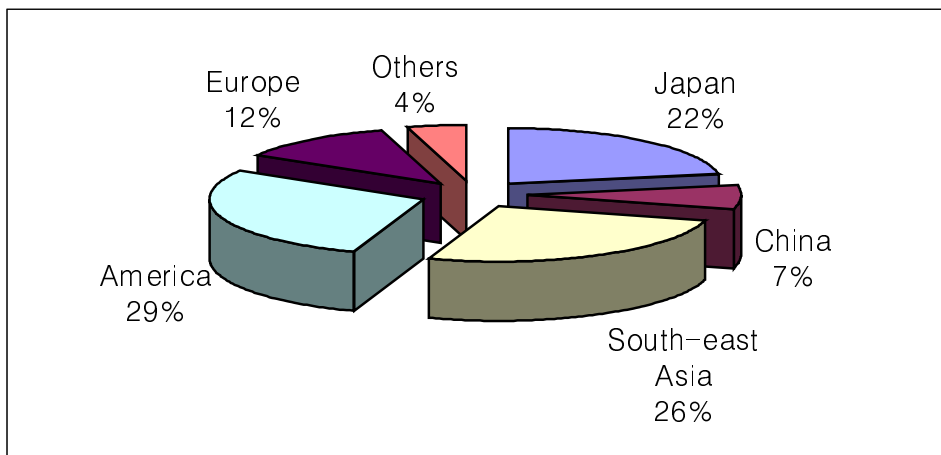
Woong-Yi Kim
Graduate Student
Department of Transportation Engineering
Hanyang University
1271 Sa-1 Dong Ansan,
Korea, 425-791
Fax: 82-2-662-5590

Abstract: Since the opening in 2001, the Incheon International Airport has been involved in efforts to establish an air cargo hub in Northeast Asia and is in the process of building a variety of infrastructure facilities. Incheon's cargo complex comprises three facilities, the first run by Korean Air Cargo, the second by Asiana Cargo and the third by IIA (Incheon International Airport) Foreign Cargo Terminal Co Ltd. The future hub ambitions of Incheon airport focus on transit cargo, particularly on the trans-Pacific sectors. The airport is planning an aggressive marketing campaign in China, targeting its carriers with the aim of encouraging them to start operations to the new airport. In this report, we focus on the air cargo hub operation of Incheon International Airport, based on an empirical study performed by us to investigate the establishment and logistics of the hub. The study involved: an evaluation of the cargo network of Incheon airport, an analysis of the changes in the airfreight system subsequent to the opening of IIA, an evaluation of the competitive responses, an evaluation of the structure of the hub operation and strategies for the construction of a network in North-east Asia. We have also developed a Connectivity Analysis, which provides a highly detailed complementary analysis of Incheon airport. Together, these studies provide an invaluable analysis of each airport's competitive position in the network of airlines and airline alliances. Finally, we set out the strategies for a network design for airports and air carriers in order to create a competitive environment for an air cargo hub.

Key Words: Hub airport, Air cargo, Logistics

1. INTRODUCTION

In the of air transport industry, transit cargo refers to cargo which is unpacked and reloaded from one aircraft to another during transportation from the airport of origin to the destination airport. Transit cargo is a major source of revenue for airlines, and as a result, the transit cargo market has become highly competitive, with airlines vying to attract transit cargo business, based on their specialized services. In the case of Korea, as shown in Figure 1, the major routes involved are the North America and Southeast-Asia routes. In particular, routes originating from the southeast for American destinations and those originating from America for southeastern destinations represent a significant proportion.



Source: Air transportation statistics, 2002, KADA

Figure 1. The shares of air cargo volume by destinations (2001)

The demands in the Asia-Pacific air cargo industry have been a highest growth rate in the world, and are expected to continue to increase at a double-digit growth rate. The new Incheon International Airport is geographically located at the frontline of the North Pacific and Siberian routes connecting Europe and North America, the centers of the air cargo market. Since it neighbors on the Asian and Chinese markets, which have high growth potential, the government of Korea intend to be the Incheon International Airport, become the heart of the world's air cargo industry in the future. The Incheon International airport is making concerted efforts to develop into the hub airport of the Northeast Asia region. In the past, Gimpo airport also endeavored to strengthen its marketing strategies and facilities in order to become the hub airport of the Northeast region. However, these efforts were hampered by the limited space for expansion at the Gimpo airport and Incheon International Airport now strives to become the air cargo hub. The research for this paper is based on the project "The feasibility of a common-user air cargo terminal in the Incheon International Airport" which covers the second

phase construction of the air cargo hub of Incheon International Airport. We analyze the air cargo demand and hub strategy related to this project. The project, ordered by the Incheon International Airport Cooperation (IIAC) and studied by us, focuses on the extension of the air cargo facilities to prepare for full utilization by 2004. In response to the results of this research, the IIAC is now constructing a common-user air cargo terminal in Incheon airport. This research differs from that of existing papers on the air cargo hub, in that it focuses on the network surrounding the air cargo hub through a comparison of air cargo systems between Incheon airport and Gimpo airport. At the time when Incheon International Airport was opened, various hub plans were examined, the performance capability for each having already been established and analyzed. In order for Incheon to become a competitive airport, it is important that it develop a variety of hub strategies. Our research therefore included the following aspects:

- Evaluation of the Cargo network of Incheon airport
- Analysis of the change in airfreight status following the move to the New Incheon airport
- Analysis of the competitive power of Incheon airport compared with surrounding airports
- Evaluation of the structure of the hub operation and strategies for network construction in Northeast Asia

In the following section, we discuss the forecasts for air cargo demand in general, and the specific air cargo forecasts for Korea. In addition, we explain the characteristics and status of the air cargo industry in Korea and analyze the changes in the air cargo system after the opening of Incheon airport. Based on this analysis, the following section analyzes the air cargo network and suggests strategies for the hub airport.

2. THE AIR CARGO FORECAST

2.1 International air cargo outlook 2001-2005 by IATA

Following the previous years of strong growth and returning optimism in the airfreight industry, IATA's original forecast of no growth in 2001 and only a 3.9% average annual growth rate (AAGR) over the period 2001-2005 represented a considerable drop in confidence in the industry. This forecast, made in June of 2002, soon needed to be revised due to the consistent decline in freight tonnage through to the end of 2001. This resulted in IATA's lowest ever five-year AAGR freight forecast, of 2.0%. Using ICAO data as a base for 2000, this interim projection predicted 20.8m tones of international airfreight in 2005, an increase of

2.0m over the 2000 level. It is also noticeable that the current consensus is for a gradual growth over the next four years, rather than the rapid rates experienced as recently as 1999 and 2000. If recovery in the main freight-generating economies is apparent by the time the 2002-2005 forecast is released, a more optimistic viewpoint may emerge. The Asian economies bounced back from their 1997/98 recessions in the ensuing two years, demonstrated by airfreight growth within the region in excess of 10% in both 1999 and 2000, and prompting a 5-year AAGR of over 7% to be forecast for the period 2000-2004. However, this trend was reversed in 2001, when the Japanese, Taiwanese, Singaporean and Hong Kong economies all swung from expansion into contraction.

Intra-Asian airfreight is strongly reliant on Japan, which features in seven of the top ten country pairs; and unfortunately, the economic prognosis for Japan is for the 2001 recession to continue into 2002. The advanced Asian economies are all anticipated, by the International Monetary Fund (IMF), to expand in 2002, but in each case more slowly than in either 1999 or 2000. A similar pattern emerges among the developing Asian economies. As a group, their growth appears to have peaked in 2000, and then slowed in 2001 with stabilization anticipated in 2002.

2.2 The forecast for air cargo in Korea

Currently, a considerable growth in the demand for air cargo rather than other transportation is being seen in Korea because of the positive trend in many factors affecting the aviation market. In addition, as shown in Table 1, this increased demand has some relation to the national growth index such as GNP/GDP. The volume of international air cargo rose 1,062.2% in 2001 while domestic air cargo, both regular and irregular, rose 1,010.2% compared with figures for 1980. The demand for air cargo continually fluctuates in relation to changes in the social and economic environment as well as international issues. For example, the oil shock in the late 1970s, and more recently the foreign exchange crisis of 1998 and the impact of the 9.11 terrorist attacks all resulted in the contraction of the aviation market. Following the oil shock, the demand for domestic air cargo dropped by 11% in 1980 compared to the previous year. The demand then maintained a steady growth until 1997. However, in 1998 the demand for air cargo demand again dropped sharply due to the foreign exchange crisis. By 2001, the demand had recovered to the same level as that before the foreign exchange crisis.

Table 1. International/domestic air cargo results & GDP

Year	GDP (billion won)	International (ton)	Domestic (ton)
1990	178,797	761,102	179,784
1992	245,700	797,251	237,053
1994	323,407	1,017,922	300,290
1996	418,479	1,338,391	347,778
1998	444,367	1,377,487	358,064
1999	482,744	1,624,747	384,306
2000	517,097	1,885,581	430,996
2001	551,742	1,793,648	423,512

Source: National statistical office, Korea Civil Aviation Development Association

The economic growth rate for northeast Asia for the period up until the year 2020 is forecast at a low average of 2.1%. Japan, in particular, is showing a lower economic growth rate because of a low birthrate and the slower growth in consumption and services. Compared with this, higher economic growth rate is forecast for Korea. Overall, the growth rate for all air transportation in Northeast Asia is forecast at 5.8% for the coming 20 years. It is envisaged that the opening of the Incheon airport will provide the capacity to cope with the increase in air traffic. Given these forecasts for airfreight volumes, the research that we have carried out is required in order to analyze whether the Incheon International Airport would be viable as the hub airport. Because of the new airport has been in operation for only one year, the airfreight forecast was carried out using a regression analysis based on data from the Gimpo International Airport for the past 20 years. Table 2 shows the estimated results.

Table 2. The forecast of International air cargo forecast

Year	GDP (1billion-won)	Performance (Ton)	Forecast (Ton)
2000	517,097	1,885,581	1,705,120
2001	551,742	1,793,648	1,814,011
2005	715,144	-	2,327,584
2010	979,810	-	2,971,475
2015	1,329,867	-	4,259,657
2020	1,788,072	-	5,699,796

The regression analysis shows a continuous increase in airfreight demand over the period studied. It appears that airfreight is selected more often as the preferred means of freight transportation. As integrators such as DHL, UPS and FedEx extend their business; the Incheon

International Airport is expected to take on the role of a logistic center. There is therefore the probability of additional demand for services at the airport.

Using the table, the rate of increase for pure freight was calculated to be 6.4% between 2000 and 2005, 6.3% between 2006 and 2010, 6.18% between 2011 and 2015, and 6% between 2015 and 2020. IATA forecasts that international airfreight will rapidly increase between 2002 and 2005 in both North America and the East Asia regions with a rise in the annual average of more than 7% from 2003. In accordance with the nature of the hub of the Incheon International Airport, the additional freight demand is limited to that for only pure freight. The forecasted demand in the above table is that for total freight demand. The results used from past years were therefore divided into freight, baggage and mail-based for the purposes of forecasting demand. Using this method of calculation, the international airfreight demand for the Incheon International Airport could be estimated as indicated below.

3. THE CHARACTERISTICS OF THE AIR CARGO

3.1 The status of the air cargo

In Korea, there are six international airports, at Incheon, Kimhae, Jeju, Chungju, Daegu, and Gwangju, for dealing with both international and domestic flights, and ten regional airports for dealing with domestic flights. Twelve of these airports are shared with the military. At present, there are 26 domestic routes involving 231 flights a day and 124 international routes, involving 742 flights per week undertaken by domestic airlines in Korea. In addition, there are 132 international routes with 519 flights per week by foreign airlines in Korea. In 2000, before the opening of the Incheon International Airport, Seoul (Gimpo) International Airport was ranked the sixth airport for air cargo traffic with a 13.2% rise to 1,874,228 tons from the previous 1,655,345 tons per year according to ACI statistics.

International air cargo traffic showed a steady increase with an annual average of 12.9% between 1991 and 1997. In 1998, there was a drop of 9.8% compared with the previous year, but in 1999, it rose dramatically by 16.9% to 1,719,428 tons and in 2000 to 1,949,352 tons. In 2001, it dropped again by 4.4% to 1,863,832 tons compared with the previous year because of the economic downturn and security concerns. The Korean aviation industry, on the other hand, has been growing rapidly since 1998. Traffic, including air cargo in the standard of ton-km, ranks third out of the 187 countries that joined the ICAO. Gimpo Airport ranks fifth amongst the world airports, but in 2001, Incheon airport ranked only fifteenth because of the separation between international and domestic traffic following its opening.

3.2 Present Status of Incheon International Airport

Incheon International Airport (IIA) opened on March 29, 2001 under an ambitious plan to become the hub of Northeast Asian air traffic. Currently, handling 327 international passenger flights and 10 domestic flights daily, the airport is used by 52 airlines, including the two national flag carriers - Korean Air and Asiana Airlines. On its 11.55 million m² site the airport has two 3.75 km-long runways, enabling supersonic and super-sized airplanes to land or take off 24 hours a day. In 2000, Gimpo airport was ranked fifth, with a volume increase of 13% compared to that a year previously. However, Incheon airport, dealing only with international air cargo, is ranked fifteenth because of the separation between international and domestic air cargo following its opening. With three cargo terminals, as shown in Table 3, Incheon International Airport ranks as one of the largest cargo airports in the world. Terminal A, belonging to the world's second-biggest cargo carrier, Korean Air, has the capacity to handle 800,000 metric tons of freight annually. Terminal B, operated by Asiana Airlines, is capable of processing up to 400,000 metric tons of cargo per year. Terminal C is run by the IIAC Foreign Carrier Cargo Terminal Co., and has a capacity of 400,000 metric tons of freight annually. Each terminal has its own automated system for cargo transfer that includes state-of-the-art cargo-handling equipment. In addition, the terminals include 121 workstations and ultra-modern refrigerators, freezers, and temperature-controlled rooms. These features allow IIA's cargo terminals, which are privately managed, to offer a wide variety of customized services to international corporations.

Table 3. Cargo Facilities of IIA air cargo terminals

Classifications		Terminal A	Terminal B	Terminal C	Terminal D	Inter-modal storage	Total	
Area (m)		360×105 (105×420)	270×105 (105×420)	KAS	210×105	3 Building	39×280 2 Building	1,050 ×105 (A,B,C) Terminal total)
				AAS	120×102			
				FDX	60×105			
				UPS	30×105			
				Total	420×105			
Sub-total		37,800 (44,100)	28,350 (44,100)	44,100	-	21,840	72,240 (154,140)	
Canopy	Air Side	25m	15m	15m	-	-	-	
	Land Side	10m	10m	10m	-	-	-	
Floor space	Terminal	57,864 (7,739)	33,736 (18,336)	57,342	2,133	11,596	162,671 (188,746)	
	Agent Bdg'	7,810	7,966	6,459	-	-	22,235	
	Other	237	-	-	-	-	237	

	Sub total	65,911 (73,650)	41,702 (60,038)	63,801	2,133	11,596	185,143 (211,219)
	Capacity(Ton)	1,030,000	710,000	520,000	-	-	2,260,000
	Owner	Korean Air	Asiana	Incheon Int'l Airport Foreign Carrier Cargo Terminal Co.Ltd	Asiana Airport Development	Incheon Air Cargo Terminal Co. Ltd	
	Terms of free use	20 years	20 years	12 years	12 years	20 years	

Source: Incheon International Airport Cooperation, 2002

Note: Terminal A in 2002, Terminal B in 2003, are to have additional expansion plan, the numerical value of () means, and the one of () of sum column, is standard as of 2003.

4. THE AIR CARGO HUB

4.1 An analysis of the air cargo hub at IIA

In terms of location, Incheon is situated in a highly advantageous position. Within three hours and 30 minutes of flight time of the airport are over 40 cities of more than 1 million citizens each, with the total combined population reaching 1 billion. Eastern America and major European cities can be reached by non-stop flights, with the possibility of flying times reduced by three hours if routes over Siberia or China are allowed in the future. Unlike Kansai or Chek Lap Kok Airport, IIA benefited from a more favorable construction site. Whereas Kansai was built on 100-percent reclaimed land, and Chek Lap Kok on a once cone-shaped area that had to be flattened, Incheon was built on coastal land. By minimizing the site development expenses, the airport was able to drastically reduce airport utility fees that amount to only 30 to 70 percent of those of competing airports. Incheon's fees are 70 percent of Hong Kong's and 35 percent of Osaka's. The airport also boasts high-tech facilities comparable to other world-class airports. Together, these features form the best conditions for an air cargo hub.

This section examines the general conditions prevailing when Incheon airport opened in 2001, as well as comparing it with Gimpo airport. Even though it is still too early to determine the success or failure of the air cargo hub using statistics, the hub functions are analyzed in order to gain an understanding of how Incheon airport is different from Gimpo airport. In 2001 following the opening of Incheon airport, air cargo volume dropped to 1,863,832 tons, a decrease of 4.4% compared with the previous year (see Table 4). This was the first decrease after 1990, except for the decrease in 1998, attributed to the impact of the deep economic depression.

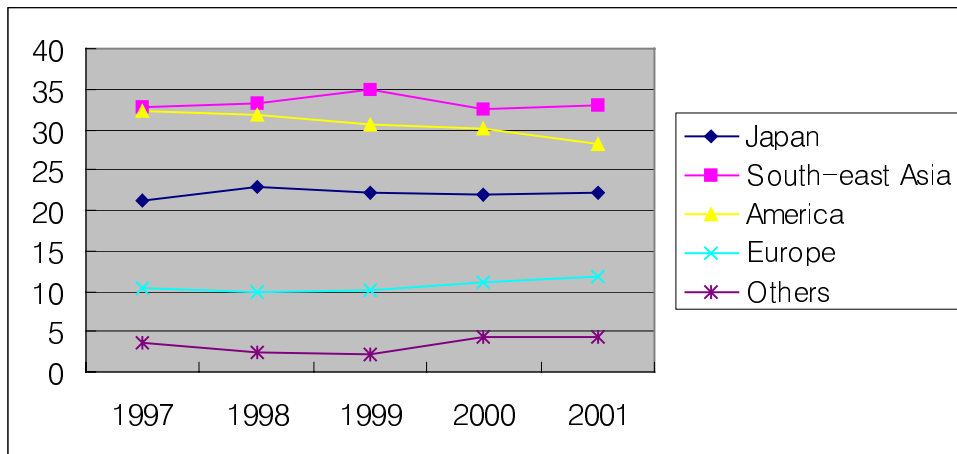
Table 4. International Air cargo Volume (Tons)

	Total	Schedule			Non-schedule		
		Sub-total	Freight	Mail	Sub-total	Freight	Mail
1991	787,342	762,733	750,262	12,471	24,609	24,519	90
1992	837,211	797,251	785,809	11,442	39,960	39,835	125
1993	950,574	870,409	856,639	13,770	80,166	79,865	301
1994	1,112,844	1,017,922	1,001,314	16,608	94,922	94,371	551
1995	1,290,749	1,198,087	1,180,588	17,499	92,660	92,152	508
1996	1,430,973	1,338,391	1,321,374	17,017	92,582	92,151	431
1997	1,631,074	1,542,442	1,526,761	15,681	88,632	88,382	250
1998	1,470,751	1,377,488	1,358,916	18,572	93,263	92,519	744
1999	1,719,428	1,624,747	1,604,229	20,518	94,681	94,251	430
2000	1,949,352	1,885,581	1,865,257	20,324	63,771	63,621	150
2001	1,863,832	1,793,648	1,768,435	25,213	70,184	69,844	340

Source: National statistical office, Korea Civil Aviation Development Association

Following the opening of Incheon airport, transit cargo volumes dropped because of the decrease in total cargo traffic. In addition, the new airport is not operational compare with old Gimpo airport. However, the traffic is again beginning to pick up in 2002. The transit rate at Incheon airport has reached 50%, which means that Incheon airport is playing the role of a hub airport. Figure 1 shows international air cargo volume by destination. The volume in 2001 comprises 28.3% destined for America, 22.2% for Japan and 11.9% for Europe. International air cargo volume by destination at Incheon airport comprises 51% destined for America and Japan. A feature of interest is that the air cargo volume to China has increased by 30% each year. For this reason, the statistics for China are separated from those for Southeast Asia. In spite of the predictions by the IMF and the effects of the 9.11 terror attacks, air cargo volume is rising more and more because of the expanding routes and increasing flights in China.

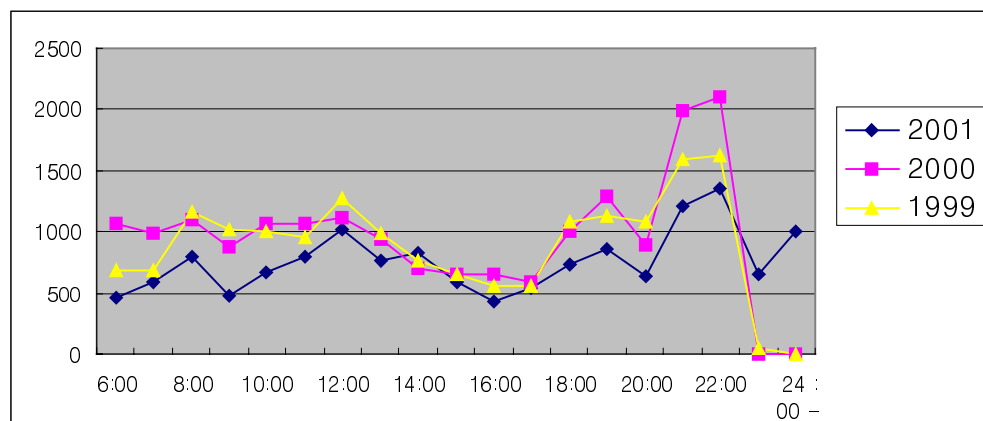
Figure 2 shows the changes in air cargo volumes by region since 1997. The volume steadily dropped in America while it rose steadily in Europe and Southeast Asia. These increases continue in spite of the effects of the terror attacks in 2001. The average peak time for air cargo traffic in 2001 was between 19:00 and 20:00, involving an average of 368 tons. In addition, the peak time for departing air cargo traffic was between 22:00 and 23:00, involving an average of 295 tons. As the Incheon airport operates 24 hours a day, the peak time for departing air cargo traffic at night is changing.



Source: Air transportation statistics, 2002, KADA

Figure 2. The change of the shares of air cargo volume by regions

The figure 3 shows the peak times in 1990 and 2000 as ranging between 20:00 and 22:00, compared with 22:00 in 2001. This means that the peak time for air cargo traffic is changing gradually with the improving nighttime efficiency of the air cargo processing facilities. The air cargo traffic pattern of Incheon airport analyzed above does not differ greatly from that seen at Gimpo airport. Because of Incheon airport operating 24 hours a day, air cargo traffic is equally distributed by time although the total volume drops because Gimpo airport deals with the domestic cargo. When it comes to analyzing the volumes in terms of the development of the hub airport, the consistent increase in international air cargo and transit air cargo in Southeast Asia and China will help to establish an environment conducive to the success of the hub airport.



Source: Air transportation statistics, 2002, KADA

Figure 3. The change of the shares of air cargo volume by regions

4.2 The plan of the air cargo hub at IIA

The strategy of the air cargo hub at Incheon International Airport is aimed at supporting the airport operation, offering air cargo users the most convenient service, and at increasing airport revenue. This strategy requires not only an increase in the capacity of the airport gates, but also the construction of an air cargo infrastructure that integrates a variety of cargo-handling systems. In further the plans of becoming the hub, the concept of a Pan-Port was introduced. This involves a complex of harbor, information communication, business, and leisure as the center of the Incheon airport.

Statistics gathered by the Incheon airport show that for the year 2002, a total of 163,480 tons of cargo have been processed at the airport as of April this year, a figure up by 18 percent on that for the same month last year. By 2005, Incheon aims to be ranked as the world's third largest airport in terms of cargo handling, and to become the region's hub airport by 2010. As incentives, the airport plans to utilize its relatively low airport charges, 24-hour operation, and its ability to handle super-sized airplanes weighing up to 600 tons. The airport is concentrating its efforts on reaching a transit cargo rate of 70 percent and 65 airlines are operated by the year 2005. In terms of plans for the air cargo hub airport, the airport authority has recently begun construction of the second phase cargo facilities and will have built the fourth of these facilities and a common-user cargo terminal by the end of this year. In addition, it will designate and bring into operation the free trade zone. The plan for the second phase extension of the air cargo facilities and the free trade zone for the hub of the Incheon airport are outlined below.

4.3 The Second-phase construction

Widely regarded as the most important project for the airport becoming a hub aviation center, the second-phase construction project of IIA was originally scheduled to start with the clearing of the construction site this year, with actual construction to begin from the second half of next year. However, to rekindle the stagnating domestic construction industry, the launch of construction was moved forward to the second half of this year. The second phase includes the construction of an additional runway, a boarding terminal and a moorage area of 1.55 million m². In total, 8.25 million m² will be added to the current facilities. By 2005, a 4,000-meter long runway for commercial aircraft of 600 tons, a moorage area for an additional 56 planes and a boarding terminal that can accommodate 32 planes at once, will be completed. By drawing in private investments, a cargo terminal of 99,000 m², additional oil feeding facilities and maintenance facilities will be installed in addition to various flight safety equipment and an Intra-Airport Transit (IAT) system that will run between the boarding terminal and the passengers' terminal.

The second phase of construction will be completed by the end of 2008 with a 5.09 trillion won investment including 386.9 billion won in the form of private investments. The current airport facilities represent the first of four phases, the last of which will be completed in 2020. When all four phases have been completed, the airport is expected to sprawl over 47.35 million m², complete with five runways, a 667,000-m²-passenger terminal, four boarding terminals, a moorage area that can accommodate 252 aircraft simultaneously and a cargo terminal of 419,100 m². The airport will have the capacity to handle a total of 480,000 flights, 100 million passengers and 7 million tons of cargo annually. In the meantime, the second phase will expand the capacity of IIA to 410,000 flights a year from the current 240,000 flights. The number of passengers it can handle will increase from 30 million to 44 million and cargo-handling capacity from 2.7 million tons to 4.5 million tons.

4.4 Customs-free zone

In line with the second-phase construction project, the area around the airport will be developed into an international business and customs-free zone (CFZ). Around 1.98 million m² within the airport will be set aside for businesses specializing in loading and unloading, warehousing, sales and simple processing. About half of the current 992,000 m² has already been designated as a CFZ, which will be developed between now and 2004, with an investment of 89.8 billion won. All facilities are scheduled to be complete by 2005 with 205.5 billion won invested. This customs free zone is intended to help the airport serve as a logistics

hub. The facilities under construction will be used for the transfer, loading; unloading, exhibition and labeling of over 500,000 tons of duty-free transit freight every year.

4.5 The analysis of each airline policy for the air cargo hub

Analysis of a hub airport reveals that one of the main factors contributing to the hub function is an airline. This section analyzes the policy and strategy of the hub in view of airlines. There are two national carriers in Korea, Korea Airline and Asiana Airlines, both of which are world leaders in terms of air cargo. Korea Airline is ranked second to Lufthansa in terms of international scheduled air cargo. Table 5 shows international air cargo traffic by airlines. The share of international air cargo traffic carried by the national airlines, Korea Airline and Asiana Airlines was 75.7% in 1998, but has since decreased. In 2001, it was 65.7%, 1,225 tons out of 1,872 tons. Japan Airline has 3.4% of the market share, and Cathay Pacific 2.8%. Lufthansa and FedEx have a 1.8% share each. The share-rate of air cargo traffic by the national carriers dropped gradually each year with a more serious drop following the opening of Incheon airport. This situation is attributable to the competition among airlines and the increasing the number of foreign airlines starting to use Incheon airport. Even under these circumstances, the national carriers continue to expand their air cargo network using Incheon airport as the hub airport. An analysis of the national carriers' policy for the hub is given below.

Table 5. The International air cargo performance & share by airlines (IIA) Unit: Thousand Ton

AIRLINES	1999		2000		2001	
	Performance	Share (%)	Performance	Share (%)	Performance	Share (%)
Korean air	901	52.4	929	47.6	868	46.4
Asiana	353	20.5	393	20.1	387	20.7
Sub-total	1,254	72.9	1,322	67.8	1,255	67
Japan airlines	53	3.1	68	3.5	63	3.4
Cathay Pacific	43	2.5	56	2.9	53	2.8
FedEx	43	2.5	42	2.2	34	1.8
Lufthansa	34	2	35	1.8	33	1.8
Singapore airlines	26	1.5	32	1.6	31	1.7
Other	268	15.5	396	20.5	401	21.5
Total	1,721	100	1,951	100	1,872	100

4.5.1 Korean Air

Korean air is the second largest scheduled air cargo carrier in the world. It has a scheduled cargo ton-km of 6,357 million ton-km following Lufthansa's 7,096 million ton-km (IATA, World Air Transport Statistics, 2001). Korean Air is a member of the SkyTeam Alliance, one of the most powerful alliances within airline industry. SkyTeam Cargo is the first airline cargo alliance created around customer needs, collaborating Aeromexico Cargo, Air France Cargo, Alitalia Cargo, CSA Czech Airlines Cargo, Delta Air Logistics and Korean Air Cargo. Through one of the world's most extensive hub networks, SkyTeam Cargo offers its 176.7 million annual passengers a worldwide system of 7,091 daily flights covering all the major destinations, particularly in the Northern Hemisphere where nearly 80 percent of the world's traffic flies, while still providing a consistent standard of performance, quality and detailed attention to customer service.

The new hub at Incheon plays an important role in SkyTeam's commitment to growth. Incheon offers greater connectivity in the Asia-Pacific region than any other airport in the area. As the geographic center of the region, the airport is almost equidistant – about two hours – from Beijing and Tokyo. Based on its strong presence and its SkyTeam member status, Korean Air is expected to be positioned as a significant cargo carrier serving North-east Asia. Cargo customers have access to a combined fleet of 1,213 aircraft making 8,723 daily flights to 891 unduplicated destinations in 114 countries. SkyTeam Cargo optimizes its global route network through a system of six major cargo hubs around the world. Korean Air's new hub at Incheon International Airport offers user access to more than 40 major cities within four hours flying time, providing fast and convenient connections throughout Asia.

4.5.2 Asiana Airlines

Asiana Air Cargo business has quadrupled in annual gross sales since it started with one air cargo plane (B747-400F) in November 1994. Currently, Asiana is operating five cargo planes (2 leased planes not included), which reflects rapid and successful expansion. In addition, as the first airline to start an Internet reservation service in 1999, Asiana Airline has vigorously steered toward e-business in the national and international air carrier industry. Cyber Express, cargo Audio Response System (ARS), internet tracking, space auction and 5-hour door-to-door air delivery are specific examples of Asiana's effort in creating new products and services in the cyber market and Asiana Airline promises to be a responsible pioneer of the air cargo industry with the opening of the new cargo terminal at the Incheon International Airport.

In spite of the 9.11 terror attacks, Asiana Airlines air-cargo traffic was 473,291 tons in 2001, which shows a slight increase compared to figures for 2000. Forecasts are up 8.8% for 2002. Compared to other airlines, Asiana Airlines has a rather low volume of traffic. However, using

Incheon airport as the hub airport, Asiana Airlines focuses on the markets of China and Southeast Asia and is exploring new routes in these areas. In case of Southeast Asia, the Thailand and Singapore routes show no significant rise in traffic compared to last year. On the other hand, forecasts for the Philippines show a 5-7% growth for which preparations are being made. Vietnam and the Philippines are part of the hub network of the Incheon airport.

Given this situation, Asiana Airlines has embarked upon a strategy to improve profit and loss using such means as developing new high revenue routes, extending the existing high revenue routes, and resolutely cutting back on low revenue routes. In addition, sales channels are being diversified through expanding the Horizontal and Vertical alliance systems for both regions and routes and by forming alliances with large forwarders such as Supply Chain Management. In the foreseeable future Asiana Airlines is planning to reinforce its high revenue structure by expanding sales of high profit cargo such as Express cargo, Special cargo and Small cargo. It also plans to strengthen the hub by means of developing and introducing an air cargo system of the next generation.

4.5.3 the analysis of the air cargo network

A basic analysis of the hub of the airport is required as a background against which various data can be evaluated before making decisions regarding future developments. The number of airlines served is a defining feature of a hub network, as well as being an expression of the airport's standing. In 2001, Incheon airport supported 246 routes, 1167 flights a week and served 43 foreign airlines. A hub network requires a balance of longer routes and feeder routes. It has been established that the greater the number of cities located within 2000 miles of a hub airport, and greater the number of flights in the total network, the higher the standing of the hub. Transit cargo represents about 50% of the total cargo carried by Korean Airlines. This figure is similar to that for Asiana Airlines, with transit cargo representing a considerable source of revenue for both. The opening of the Incheon airport brought with it an increase in capacity for the handling of transit cargo, a core factor in achieving a win-win situation for both the airport and the airlines, which it serves. The Incheon airport is equipped with high-tech facilities and is located at the most suitable place to function as the Northeast hub airport within the Korea-China-Japan routes. In addition, with the appropriate use of logistics, environments and geographical advantages, the competitive advantage can be extended to make Incheon airport the ideal airport to serve as a hub for the continent routes.

Regarding the trans-Pacific routes, Incheon airport is located at the boundary distance where B747-400 aircraft are capable of a nonstop flight from Incheon airport to the cities of the

American East coast. In addition, nonstop flights from Incheon airport to Europe are possible using routes over Siberia or trans-China. Despite Beijing being the frontline for Europe routes, and Tokyo the frontline for America routes, neither is better located than Incheon airport. A further advantage identified for Incheon airport is its location between China and Japan, two of the largest markets in Asia. Furthermore, both Narita airport in Tokyo and Kansai airport in Osaka have difficulty in performing the hub function because of their limited capacity. Beijing airport too experiences problems in this regard because of its conservative aviation policy and the inefficiency of the Chinese airlines. Based on this analysis, the scheme for the hub airport at Incheon airport is suggested the below.

4.5.4 Provision of services to and development of airlines

The combination of geographical advantage and the efficient handling of the cargo of national carriers is the main feature of an effective transit air cargo service the world over. In other words, it is impossible to overestimate the importance of airlines at a hub airport. To achieve success, a government therefore needs to offer the services of a top class hub environment together support for the growth of the airlines themselves. For example, the growth of Korean Airlines has resulted in its being the second largest air cargo company in the world. To promote the hub airport of the Incheon airport, it is essential that airline be supported in their development and that services be provided to other airlines.

4.5.6 The development of integrated transportation

Consideration has been given to the integration of other modes of transportation at the hub airport. In Europe, most hub airports are linked to a railroad system, which plays an important role as a feeder. In Korea, the integration between air and rail transport is problematic. However, with the airport being located near the sea, the integration of air and harbor transportation is being developed. In light of the increasing volumes of sea and air cargo seen in the West Sea area, the integration of air and sea transportation will play an important role in the development of the hub airport. The air cargo network is important not only to airlines but also to forwarders. In Korea, the forwarder industry is small and dependent on the airlines. The air cargo facilities at Incheon airport are designed mainly for use by the airlines and are not adequate for forwarders and consolidators. For this reason it has been difficult for forwarders to develop their industry volume and their activities are limited, even with Incheon Airport's global networks. It is therefore imperative to promote the use of Incheon Airport by the large forwarders as a hub airport in order to grow the hub airport and its network and to develop its competitive powers.

5. CONCLUSIONS

It has been more than a year since the opening of the Incheon Airport. Through analysis of the air transportation network and a variety of statistics, this research shows the outcomes of efforts made to establish the Incheon Airport as the air cargo hub airport in North-East Asia.

The feasibility of growing the air cargo hub is analyzed through a comparison of the statistics for Incheon Airport and Gimpo Airport as well as the airline networks connected with both. Even though the efforts of the airport authority enabled the air cargo network to be set up within a relatively short period following the opening of the airport, the economic downturn in the region and global security concerns resulted in a drop in air cargo traffic.

The air cargo network consists of selected North-East Asia routes. In other words, it consists mainly of dealing with the traffic of the Chinese and Southeastern routes. The study shows that the Incheon airport has made great strides towards establishing itself as the gate hub airport of North-east Asia

In this study, the hub network of the Incheon Airport was analyzed using a variety of statistics and comparisons. However, the evaluation has a number of limitations. These relate mainly to there being insufficient data for the computation of transit cargo and origin-destination data. In addition, route data, including the most recent origin-destination data, for each airline is required if an accurate assessment of the hub network is to be made. It is also still too early to determine whether the hub network of Incheon airport is successful or not.

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