ISSUE 20
KOTI Knowledge Sharing Report
KOREA'S BEST PRACTICES
IN THE TRANSPORT SECTOR

Korea's Aviation Policies

by KIM Je-chul *et al.*

THE KOREA TRANSPORT INSTITUTE

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KOTI Knowledge Sharing Report: Korea's Best Practices in the Transport Sector

Issue 20: Korea's Aviation Policies

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Dr. KIM Je-chul is Chief Director of Dept. of Air Transport in the Korea Transport Institute as a Senior Research Fellow. He joined the Korea Transport Institute in 1989 and has been performing Transport Economics, Aviation Policy and Airport Operation. He graduated from Yonsei University with master's degree in Economics and received Ph.D. in Economics at Kyunghee University. He conducted postgraduate research at the U.S Texas Transportation Institute as a visiting scholar. He is in many positions such as Advisory Committee of Incheon International Airport Corporation, Deliberative Committee of Ministry of Land, Infrastructure, and Transport. After he entered the Korea Transport Institute, he carried out many positions such as Director of Aviation Traffic Information Center, Director of Audit and Inspection.

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He likes natural life and he thinks it is need for eternal vigilance on technology without provision of nature.

KIM Jun-Hyuk

Dr. KIM Jun-Hyuk was born in Gwangju, Korea. After completing high school in Gwangju, he entered the Industrial Engineering program in Chonnam National University. In his undergraduate period, he has served in Republic of Korea Navy as a sailor for three years. He came back to the university and has completed bachelor degree in 1997. Upon completion of his bachelor degree, he entered the graduate school in Chonnam National University for his master degree in Operations Research. After earning the master degree, he started Ph.D. study at Virginia Tech. During pursing his Ph.D. degree, He worked as a teaching assistant and also as a research assistant. After receiving Ph.D. in Air Transportation System, he joined Navitaire, Inc. (part of the Accenture Consulting) located in Austin, Texas as an Operations Research Scientist and conducted many research/consulting projects in Aviation Sector (both in public and private). In 2012, he joined the Korea Transport Institute and has been conducting various research projects in the area of future air navigation policy and technology, and aviation security management since then. Currently, he is serving as an Associate Research Fellow in KOTI.

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LEE Seungho joined Dept. of Air Transport in the Korea Transport Institute since 2006 and currently he has been participated various international project and international entity cooperation as a Sr. analyst as well as chief of overseas liaison. He has been performed aviation policy (Open Skies) analysis and aviation safety information technology research for ICAO SMART. Furthermore, he also performed numerous international airport master plan studies in collaboration with international cooperation agencies and foreign governments. Recently, he is providing aviation safety IT program lecture to the developing countries' aviation safety auditors along with the communication for international airport planning project. He is still persuading IFR rating.

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• Preface

Korea has achieved phenomenal growth over the past 40 years based on its consistent construction of transport infrastructure such as roads, railways, airports and ports. The nation kept expanding the transport infrastructure while implementing its Five-Year Economic Development Plans. It even introduced a special account designed to facilitate the installation and maintenance of transport facilities. Such a development scheme, which made it possible for Korea to attain the status of a developed country, is now being closely watched by the world.

Korea has turned itself into an aid donor after being a recipient of international aid until the 1990s. This has not only promoted Koreans' self-esteem but enhanced the nation's image in the global community, particularly among developing countries. Korea is now providing aid to countries in Africa, the Middle East and South America as well as in Asia. The scope of support is also expanding to cover economic development planning and various other areas such as new town construction, infrastructure expansion and policy consultation.

Recently, numerous developing countries are showing a keen interest in the development of transportation in Korea. Equipped with the world's highest level of information and communications technology, Korea continues to build up its intelligent transportation systems (ITS). It has also reformed its public transport system a feature bus rapid transit (BRT), a convenient transfer scheme, and transit cards that provide nationwide compatibility. Other prominent achievements include the development of domestic technologies for high-speed rail systems and the operation of a world renowned international airport. As such, Korea is considered to be a

role model by a growing number of developing countries.

However, despite this transport knowledge sharing, we have overlooked sharing comprehensive our expertise concerning air policies including air transport and airport development which has coped with and overcome significant changes in the air transport field. This book covers the advance and achievements of the air industry in Korea.

This book represents our determination to share Korea's precious experience and know-how with numerous countries, thereby laying the foundation for creating new values in the global era.

LEE Chang Woon
President
The Korea Transport Institute

KIM Je-chul

Senior Research Fellow,
The Korea Transport Institute

Chapter
01

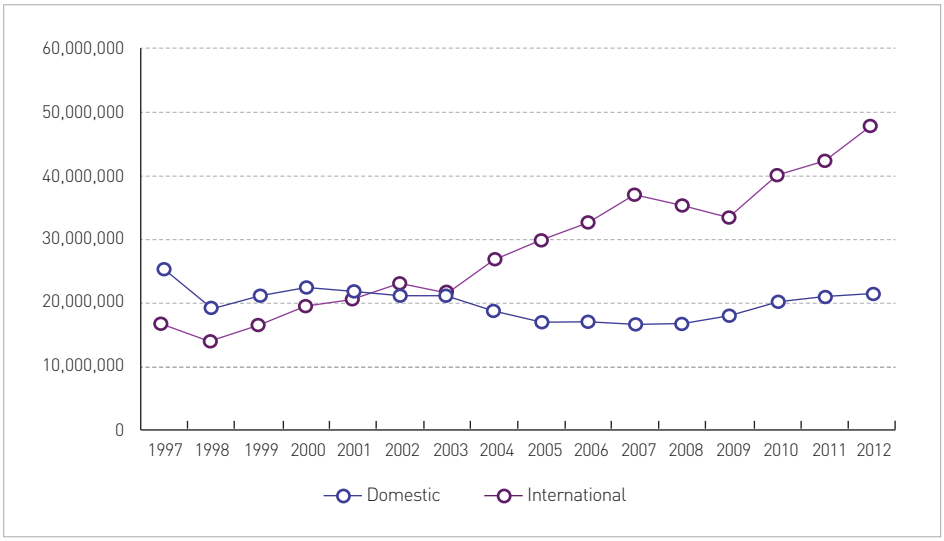
State of the Aviation Sector

Section 1

Air Transport

Korea has achieved phenomenal growth in aviation with being listed as a global power in the air transport sector. As of 2012, it ranked sixth globally in terms of overall air transport performance. In the categories of passenger traffic and cargo transport, it was placed 15th and third, respectively. Major Korean flag carriers are playing increasingly important roles in the international air transport market. Korean Air is ranked 13th in terms of passenger-kilometer on the IATA list of the world's prominent airlines. Asiana Airlines is placed 29th. Both carriers belong to global alliance groups of airlines. By operating their international aviation networks, these two flag carriers are providing people with travel convenience and ensuring efficient handling of air cargo. Consequently, they are making significant contributions to the national economy. Between 2001 and 2012, Korea's air passenger traffic expanded by an average of 4.8% a year. The cargo sector recorded an average yearly growth rate of 4.1% during the same period. Performance of domestic flights dwindled by average annual rates of 0.7% and 3.9% for passenger and cargo transport, respectively, due to the opening of various expressways between 2000-2010 and the KTX high-speed rail system in 2004. Of late, however, the domestic sector is recovering from a slowdown

Figure 1.1 Trends in domestic and international air traffic performance by year (Unit: passengers)



with low-cost carriers increasing flight operations. International air passenger and cargo traffic has increased by average annual rates of 12.5% and 6.3%, respectively. International performance went down in 2003 amid such unfavorable developments as the Iraq War, SARS, and a surge in domestic credit delinquencies. Temporary setbacks were also recorded in 2008 and 2009 due to oil price hikes and the global financial crisis.

Low-cost carriers are also playing increasingly important roles. Several budget airlines have been established since the nation's first low-cost carrier, Hansung Air (later renamed as T'way Airlines), started commercial service in 2005. Their market share in domestic air passenger transportation rose from 0.1% in 2005 to 34.7% in 2010 and 43.8% in 2012. Meanwhile, the general aviation sector in Korea is in an early stage of development with the number of registered aircraft at 601. They consist of public and corporate aircraft as well as privately owned planes. In a related development, domestic demand for leisure aviation is steadily increasing. As of 2012, the number of registered light aircraft and ultralight flying devices amounted to 651. Their number increased by 15.6% a year on average during the 2001-2010 period. Information on these and other matters related to aviation can be accessed

via a website operated by the Ministry of Land, Infrastructure and Transport. Contents include air traffic conditions at various airports, aviation data related to livelihood, and professional knowledge on aviation. The ministry operates the service in order to enhance user convenience, ensure a coherent information service system, and protect the rights of air transport users.

Section 2

Airport Development and Operation

In Korea, a total of 15 airports are in service for civilian flights. Of them, Incheon International Airport serves as the national hub, while Gimpo, Jeju, Gimhae, Daegu and Cheongju airports function as regional main airports. The remaining nine airports are classified as regional airports. Domestic flights are concentrated on routes with Gimpo and Jeju while international services are handled mostly at Incheon International Airport and the five regional main airports. Overall, Korea's airports are maintaining operational profits. In order to ensure the operation of airports as public utilities, deficits of some airports are covered with the transfer of revenue from other airports which maintain profits.

Table 1.1 Airport operating profits and losses in 2013

(Unit: 100 million won)

Airports	Gimpo	Gimhae	Jeju	Daegu	Gwangju	Cheongju	Yangyang
Current term profit and loss	1,199	800	508	-37	-25	-51	-88
Airports	**Ulsan**	**Yeosu**	**Muan**	**Sacheon**	**Pohang**	**Gunsan**	**Wonju**
Current term profit and loss	-92	-88	-76	-41	-86	-21	-18

Air traffic demand at regional airports has continued to decrease since

2000. As for the domestic sector, contraction is related to the development of road transport as the high-speed railway and expressways have steadily made inroads into demand for domestic air travel. The regional airports are also suffering setbacks in the international flights sector as well. Airlines' heavy dependence on Incheon International Airport may be cited as the foremost contributing factor. The drop in international flights to and from the regional airports also has to do with their insufficient capacity to accommodate large aircraft. Demand for aviation services at the regional airports is predicted to decline further because of continuous advances made in the road transport sector. In the domestic sector, Jeju routes are expected to attract an increasing number of air travelers. In contrast, the number of users on routes serving inland areas is forecasted to keep decreasing. Consequentially, regional hub airports are expected to achieve continuous growth, with regional airports focusing their business strategy on Jeju routes. As of 2012, Jeju and inland routes accounted for 79% and 21% of domestic flights, respectively. Meanwhile, demand for international flight services is expected to keep expanding as a result of growth in personal income, increase of airlines' supply, increase in leisure activities, and globalization.

By using knowhow and experience related to the construction and operation of airports, Korea is actively making inroads into relevant international markets. In particular, the brand of Incheon International Airport is being used efficiently in promoting participation in airport construction and operation projects in Iraq, China, Cambodia and Russia. While promoting such overseas projects, Korea Airports Corporation is also seeking to export domestic air navigation systems to a number of countries, including Colombia.

Section 3

Aviation Safety and Technology

Korea reported a total of 91 aviation accidents between 2001 and 2010. They resulted in 60 deaths, 63 injuries and 95.3 billion won worth of economic loss. Of the accidents, 45 were airliner crashes, which caused 26 deaths, 43 injuries and economic loss of 92.3 billion won. The other 46 accidents involved light aircraft or ultralight flying devices. They claimed the lives of 46, injured 20, and caused 3 billion won of economic loss. During this 10-year period, fatalities from accidents involving light or ultralight planes outnumbered deaths from airliner crashes. Aircraft incidents that took place during the same period numbered 82. Their number gradually increased every year after reaching the low of two in 2005.

No aviation security incident has been reported in Korea since 1987. The nation attained such a level of security through incessant efforts to establish a thorough aviation security system. The efforts involved the formulation of national air security plans as well as the development of surveillance and training programs targeting personnel, cargo and facilities. The nation implements on-site inspections based on annual security activity plans in order to identify and correct deficiencies. It has also introduced the Known Shipper program to facilitate logistics flow at cargo terminals. Additionally,

the nation is operating a training institute exclusively for aviation security.

In aviation technology, Korea is making insufficient investments to commensurate with its economic strength and international status. Worldwide, Korea is among lower-middle ranking countries in terms of national R&D investment in aviation technology. However, it has made progress in developing military aircraft such as KT-1, T-50, and autonomous planes. In civil aviation the nation has developed a multi-purpose light aircraft named Changgong (Blue Sky) 91 as an eight-seat twin bee aircraft and a four-seat small aircraft named Bandiho. With the appearance of futuristic aircraft, there is a growing call for establishment of relevant types and airworthiness certification standards.

The Air Traffic Center handled 813,000 telecommunication messages in 1998. The number rose by 25.4% a year on average to 6,239,000 in 2007. It is predicted to increase 10 fold by 2020, should it continue at an average annual rate of 13.1%. Then, it would be impossible to properly implement international aviation communications under the current Aeronautical Fixed Telecommunication Network system. Air traffic to be controlled domestically is forecasted to double in volume by 2020 by growing at 3.7% a year on average. These forecasts demonstrate the need to develop new-concept air navigation and air transport management systems.

Section 4

International Cooperation and Environmental Issues

In 2001, Korea first joined the International Civil Aviation Organization governing council as a state representing the Part III group. It was reelected to the council in 2004 and 2007 for its second and third consecutive terms. Additionally, a Korean delegate is serving as one of the members of the Air Navigation Commission, which makes major policy decisions for the organization. Korea is also actively involved in IT system improvement projects for the establishment of the International Civil Aviation Organization SMART System, thus continuously expanding its cooperative ties with the organization.

Environmental issues are assuming growing importance in the international aviation sector. Originally, the aviation sector was not included in emissions reduction schemes under climate change agreements. Its exclusion from the mitigation programs was due to difficulty reaching a consensus on the method of allocating emissions among nations. However, rapid growth of international aviation has caused concerns about its environmental effects, particularly with regard to greenhouse gas emissions from high-altitude airliners. Such worries prompted the International Civil Aviation Organization to accelerate discussions on mitigation measures in the

aviation sector.

Another environmental issue that merits serious attention is related to aircraft noise. Noise damages are reported in increasing numbers as a result of implementation of urban development projects in areas affected by aircraft noise.

Collisions between birds and airplanes are being dealt with as a serious risk factor. Yet, there are no mandatory regulations on the control of external environments such as bird habitats near airports.

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Chapter
02

Aviation Industry and Regulatory System

Section 1

Aviation Statistical Trends and Forecasts

1. Korean Civil Aviation Performance

In 2012, Korea ranked sixth in the world in terms of air transport performance measured in ton-kilometer. It was placed in 15th and third place, respectively, in terms of air traffic measured in passenger-kilometer and cargo ton-kilometer. Korea maintained its sixth position for the third year in a row, just ahead of Japan and France. Its passenger-kilometers expanded by 5% from the previous year, while its ton-kilometers and cargo ton-kilometers increased by 4% and 0.5%, respectively.

In 2012, Korea's air passenger traffic amounted to about 98.7 billion passenger-kilometers, accounting for 1.8% of total operation of ICAO member states. In this category, the nation ranked 15th, following such countries as the United States, China, United Kingdom, and Germany. In in air cargo traffic, Korea ranked third after the United States and China, by recording approximately 12.2 ton-kilometers, which accounted for 6.7% of the entire performance of ICAO member states.

Despite various difficulties such as the global economic slowdown and fuel price hikes, Korea recorded an average annual growth rate of 4.73%

Table 2.1 Korean civil aviation performance rankings

Categories		2010		2011		2012		2012 growth rate (%)
		Ranking	Performance (million)	Ranking	Performance (million)	Ranking	Performance (million)	
Ton-km	Domestic & international	6	21,031	6	20,807	6	21,645	4.03%
	International	5	20,554	5	20,317	5	21,333	5.00%
Passenger -km	Domestic & international	15	87,457	15	93,858	15	98,727	5.19%
	International	9	82,651	8	89,089	9	93,928	5.43%
Cargo ton -km	Domestic & international	3	12,945	3	12,219	3	12,291	0.59%
	International	2	12,873	2	12,162	2	12,231	0.57%

Note: 2012 figures represent tentative estimates.
Source: Korea Civil Aviation Development Association, Aviation Statistics (International), 2013.

Table 2.2 2012 civil aviation performance statistics of major countries

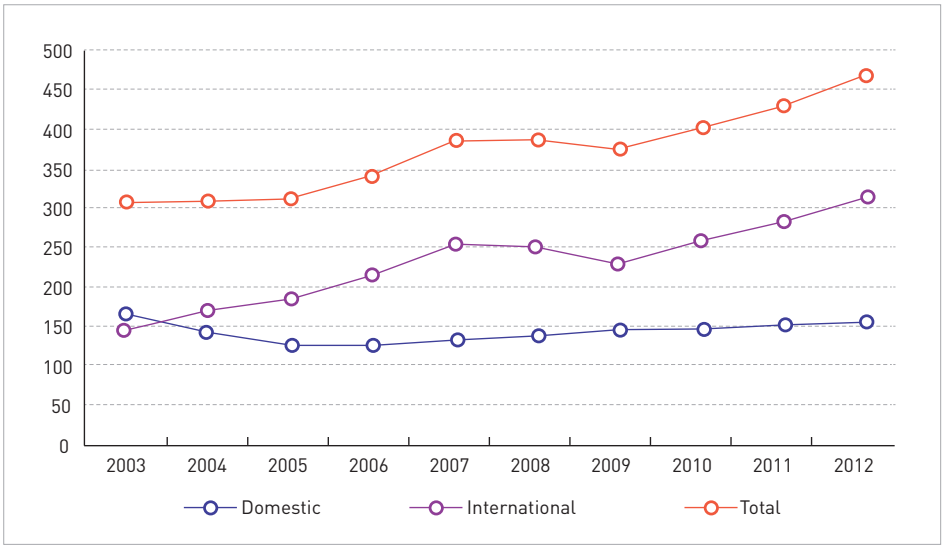
Ranking	Country	Ton-km		Passenger-km		Cargo ton-km	
		Performance (million)	Ratio (%)	Performance (million)	Ratio (%)	Performance (million)	Ratio (%)
1	U.S.	160,758	23.4	1,324,750	24.5	39,104	21.4
2	China	60,566	8.8	500,258	9.3	15,569	8.5
3	UAE	36,096	5.3	246,112	4.6	11,898	6.5
4	Germany	29,306	4.3	218,902	4.1	7,241	4.0
5	U.K.	28,868	4.2	251,626	4.7	6,251	3.4
6	Korea	21,645	3.2	98,727	1.8	12,291	6.7
7	France	19,975	2.9	166,193	3.1	4,554	2.5
8	Japan	18,858	2.7	138,059	2.6	7,036	3.9
9	Singapore	18,471	2.7	111,526	2.1	7,507	4.1
10	Russia	17,837	2.6	150,872	2.8	4,132	2.3
11	Australia	15,613	2.3	135,664	2.5	2,731	1.5
12	Netherlands	15,485	2.3	93,794	1.7	5,989	3.3
13	Canada	14,563	2.1	127,904	2.4	1,966	1.1
14	Brazil	11,577	1.7	111,425	2.1	1,364	0.7
15	Turkey	11,500	1.7	96,488	1.8	1,933	1.1
ICAO total		686,609	100	5,401,797	100	182,429	100

Note: 2011 global air traffic performance estimates.
Source: Korea Civil Aviation Development Association, Aviation Statistics (International), 2012.

between 2003 and 2012 in its civil aviation performance (international + domestic), as shown in Table 2.3. Domestic air traffic dwindled by 0.69% on average during this period. It suffered negative impacts from the appearance

Figure 2.1 Trends in domestic and international air traffic

(Unit: 1,000 flights)



of other competitive modes of transport as demonstrated by the successive opening of expressways from 2001 and the opening of the high-speed rail system in 2004. After 2005, performance on domestic air routes began to improve with the market entry of low-cost carriers. International air traffic went down 1.2% and 7.2% in 2008 and 2009, respectively, due to the global economic crisis.

Korea's passenger air traffic increased by 5.49% a year on average during the 2003-2012 period. During the same period, passenger traffic on domestic routes shrunk by an average annual rate of 0.11%. International passenger traffic rose 9.28% a year on average during the ten years, despite unfavorable impacts from the 2008-2009 global economic crisis. As of 2012, international passenger traffic held a market share of 68.8%, compared with 31.2% of domestic passenger traffic.

As outlined in Table 2.5, Korea's international and domestic cargo traffic increased by 3.14% a year on average between 2003 and 2012. Domestic cargo traffic kept declining during the period, recording a negative growth of 5.06%. International cargo traffic increased with exception for 2008-2009 when it slightly went down because of the global economic crisis.

Table 2.3 Civil aviation performance statistics

(Unit: 1,000 flights/%)

Categories		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Growth rate per year
Domestic	Performance	166	144	128	127	133	140	147	147	152	156	-0.69
	Year-on-year growth rate	-	-13.3	-11.1	-0.8	4.7	5.3	5.0	0.0	3.4	2.6	
International	Performance	144	170	186	214	253	250	232	257	281	314	9.05
	Year-on-year growth rate	-	18.1	9.4	15.1	18.2	-1.2	-7.2	10.8	9.3	11.7	
Total	Performance	310	313	314	341	386	390	379	404	433	470	4.73
	Year-on-year growth rate	-	1.0	0.3	8.6	13.2	1.0	-2.8	6.6	7.2	8.5	

Source: Korea Civil Aviation Development Association, Aviation Statistics (Domestic), 2004-2012.

Table 2.4 Air passenger statistics

(Unit: 1,000 passengers/%)

Categories		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Growth rate per year
Domestic	Performance	21,380	18,893	17,158	17,181	16,848	16,990	18,061	20,216	20,981	21,602	0.11
	Year-on-year growth rate	-	-11.6	-9.2	0.1	-1.9	0.8	6.3	11.9	3.8	3.0	
International	Performance	21,459	26,931	29,684	32,705	36,856	35,341	33,514	40,061	42,649	47,702	9.28
	Year-on-year growth rate	-	25.5	10.2	10.2	12.7	-4.1	-5.2	19.5	6.5	11.8	
Total	Performance	42,839	45,824	46,841	49,889	53,704	52,331	51,575	60,277	63,630	69,304	5.49
	Year-on-year growth rate	-	7.0	2.2	6.5	7.6	-2.6	-1.4	16.9	5.6	8.9	

Source: Korea Civil Aviation Development Association, Aviation Statistics (Domestic), 2004-2012.

Table 2.5 Air cargo statistics

(Unit: 1,000 tons/%)

Categories		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Growth rate per year
Domestic	Performance	423	409	372	355	316	254	269	262	281	265	-5.06
	Year-on-year growth rate	-	-3.3	-9.0	-4.6	-11.0	-19.6	5.9	-2.6	7.3	-5.7	
International	Performance	2,209	2,569	2,617	2,854	3,138	2,997	2,872	3,327	3,238	3,209	4.24
	Year-on-year growth rate	-	16.3	1.9	9.1	10.0	-4.5	-4.2	15.8	-2.7	-0.9	
Total	Performance	2,631	2,978	2,989	3,209	3,454	3,251	3,141	3,589	3,519	3,474	3.14
	Year-on-year growth rate	-	13.2	0.4	7.4	7.6	-5.9	-3.4	14.3	-2.0	-1.3	

Source: Korea Civil Aviation Development Association, Aviation Statistics (Domestic), 2004-2012.

Figure 2.2 Trends in domestic and international passenger air traffic

(Unit: 1,000 passengers)

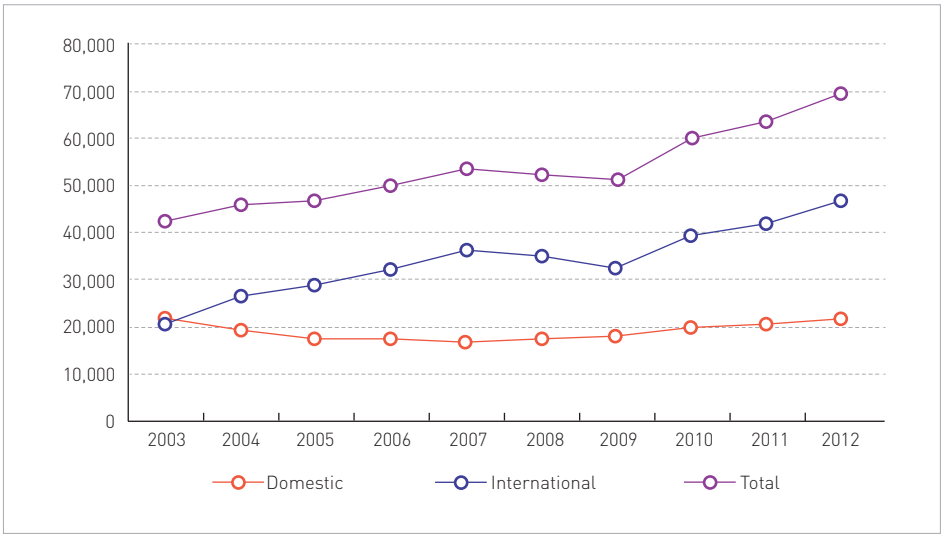
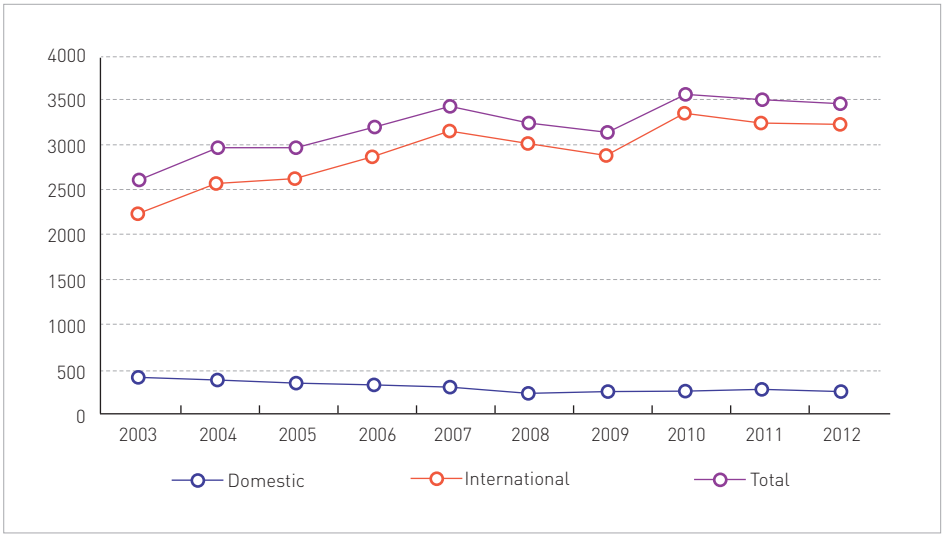


Figure 2.3 Trends in domestic and international air cargo

(Unit: 1,000 tons)



Consequently, the nation recorded an average growth rate of 3.14% in air cargo during the ten years. As of 2012, international cargo traffic had a market share of 92.4%, compared with 7.6% of the domestic sector.

2. Forecasts for Domestic and International Aviation

The global aviation market is undergoing significant changes amid rising uncertainties caused by fuel price and exchange rate fluctuations and the economic crisis. Prominent international agencies predict that the global aviation market will steadily expand at an average annual rate of about 5% over the next 20 years. They forecast that passenger and cargo traffic will grow at similar rates.

Table 2.6 Forecasts and outlook of global aviation demand

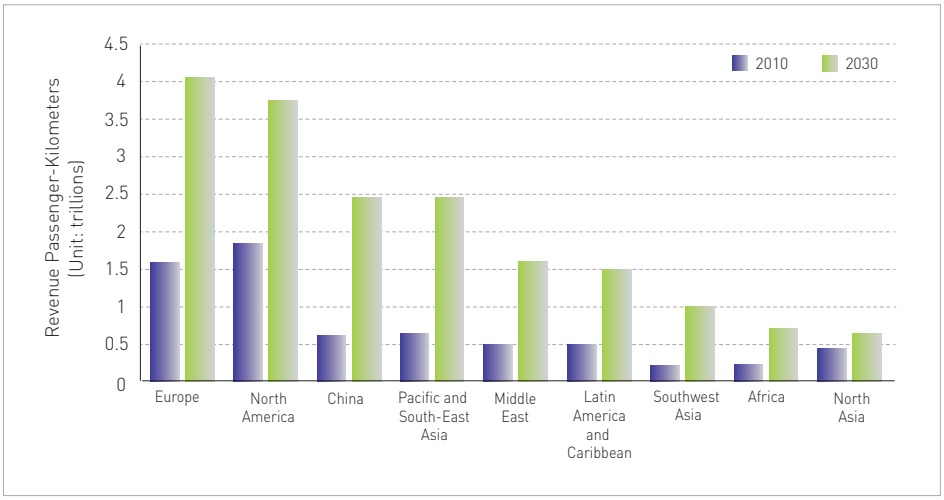
	Agencies	Forecast standards		Target periods	Average annual growth rate (%)
Passenger	ICAO	Domestic & international	Passenger-km	2005-2025	4.6
	IATA	International	Number of passengers	2007-2011	5.1
		Domestic			5.3
		Domestic & international			5.2
	ACI	Domestic & international	Number of passengers	2005-2025	4.0
	Airbus	Domestic & international	Passenger-km	2007-2026	4.9
	Boeing	Domestic & international	Passenger-km	2006-2026	5.0
	Embraer	Domestic & international	Passenger-km	2008-2027	4.9
Cargo	ICAO	Domestic & international	Cargo ton-km	2005-2025	6.6
	IATA	International	Cargo ton	2007-2011	4.8
	ACI	Domestic & international	Cargo ton	2005-2025	5.4
	Airbus	Domestic & international	Cargo ton-km	2007-2026	5.8
	Boeing	Domestic & international	Cargo ton-km	2006-2026	6.1

Source: Korea Transport Institute, Formulation of the 4th Comprehensive Plan for Mid to Long-Term Airport Development.

In its global air transport outlook for 2030, ICAO forecasts that air traffic demand will continue to increase to the extent that in 2030, it will be 2.3 to 2.6 times as high as that of 2010. The ICAO forecast showing that air traffic demand is expected to rise steadily in all regions (Figure 2.4) with the annual growth rate likely to exceed 4% in most of the regions (Figure 2.5). The Middle East, Latin America and the Asia-Pacific region are predicted to record particularly high growth rates surpassing 6% on average.

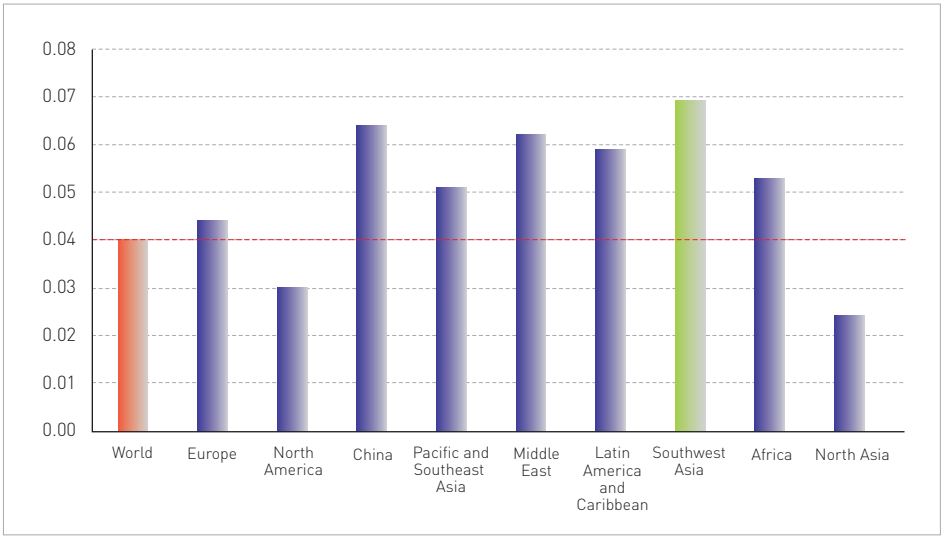
Shares of air traffic demand are presented by region in Figure 2.6. The

Figure 2.4 Global air transport demand forecasts



Source: International Civil Aviation Organization, Global Air Transport Outlook to 2030.

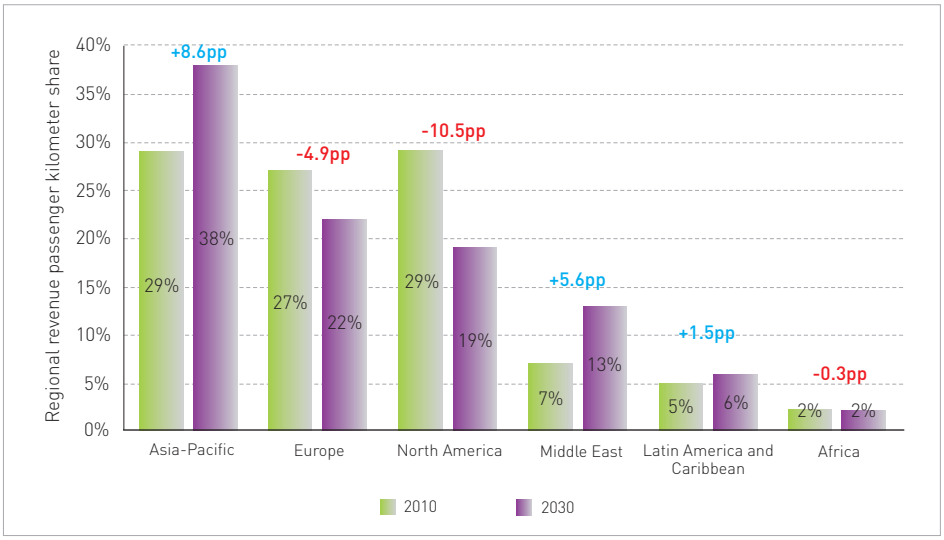
Figure 2.5 Global air transport demand average annual growth rate forecasts of 2010-2030



Source: International Civil Aviation Organization, Global Air Transport Outlook to 2030.

Asia-Pacific region and the Middle East are forecasted to increase their shares greatly. In contrast, the current high shares of Europe and North America are predicted to contract significantly.

Figure 2.6 Global shares of air transport demand by region



Source: International Civil Aviation Organization, Global Air Transport Outlook to 2030.

Given the global trends in demand and market shares, air traffic demand is likely to grow in Korea as well. The nation needs to pay particularly keen attention to predictions that China and the Asia-Pacific region will grow significantly in terms of their market sizes and shares.

Section 2

Status of Aviation Regulations

1. Changes in Aviation Policies

Changes in Korea's civil aviation policies during the past several decades can be classified into four categories (Table 2.7). The period between 1969 and 1987 was dedicated to laying the groundwork for achieving full-fledged growth of the nation's aviation industry. The period of 1988-1997 saw the internationalization of the domestic aviation industry with a rapid rise in air traffic demand. Between 1998 and 2003, Korea focused on intensifying aviation safety. Since 2004, the nation has been exerting efforts to ensure continuous growth of its air transport industry while coping with rapid changes in an environment of global aviation.

Major aviation deregulation policies implemented in Korea are summarized in Table 2.8. The aviation industry plays a dominant role in promoting international transportation. It is inevitable, from a public interest perspective, that it is subject to government regulations designed to ensure the supply of stable air services and maintain appropriate fare levels. However, excessive regulations lead to problems. In Korea, the government had long been criticized for causing a monopolistic market structure. It had also been

Table 2.7 Changes in aviation policies

Categories	1969-1987	1988-1997	1998-2003	2004-Present
Period classification	Early growth	Continuous growth and industrialization	Stable growth and increased aviation safety	Take-off and rapid changes
Aviation policy	• Period of initial growth achieved through industrialization and export-driven economic policies based on five-year economic development plans • Groundwork laid for development of the aviation industry through amendment of the Aviation Act	• Expansion of international routes • Facility improvement at domestic airports in preparation for internationalization (Formulation of the Basic Plan for Airport Development, 1991) • Sharp rise in air travel demand following the lifting of foreign travel restrictions	• Active promotion of aviation accords • Separation of aviation safety and aviation policy functions • Introduction of international standards for aviation safety policies	• Promotion of a hub strategy for Incheon Airport • Decrease in air traffic demand due to alternative means of transport and business slowdown
Regulation system	• Market monopoly • Airline privatization (Korean Air Corporation- Korean Air, February1969) • Emergence of full-fledged aviation market in Korea	• Advent of an era of free competition among multiple airlines • Introduction of a price reporting system for domestic airline tickets (1991)	• Licensing system for non-scheduled air transport operation changed to registration system (2001) • Upgrade requirement (50-seat aircraft→80-seat aircraft) (2003) • Introduction of continuous oversight functions for airlines and airports	• System improvement for provision of air services suitable for domestic conditions • Promotion of airport liberalization
Significant developments	• Appearance of large jets (B707, B747) • U.S. Airline Deregulation Act and Air Transport Competition Act	• Open Skies Agreement (U.S.-Netherlands, 1992) and New International Air Transport Policy (1995) • Europe's promotion of phased aviation liberalization	• Opening of Incheon International Airport • Abrupt changes in global aviation market environments (9/11, SARS, fuel price hikes) • Aviation Safety Category II and reinforcement of aviation safety policies • Korea elected as an ICAO Council member	• Discussion on promoting integrated air transport market involving Korea, China and Japan • Opening of the high-speed railway system • Air traffic decline at regional airports • Market entry of low cost carriers

held accountable for failing to promote airlines' autonomous operations and upgrade user services. To address these problems, the government began to ease restrictions in the latter half of the 1980s, helping to bring about structural changes in the air transport industry. In the 2000s, the government pursued a deregulation policy aimed at diversifying the aviation industry and

improving aviation safety and the quality of services in order to meet the growing public demand for diversified air services.

Table 2.8 Major civil aviation deregulation policies

Date	Primary contents
February 1969	Privatization of Korea National Airlines
February 1988	Permission for market entry of multiple airlines
June 1992	Switch to a registration system from a licensing system for non-scheduled air transport business using helicopters
February 1992	Shift from a domestic airfare reporting system to an autonomous pricing scheme
December 1993	Deregulation for air cargo forwarding and agent businesses
January 2001	Switch from a licensing system to a registration scheme for non-scheduled air transport business using aircraft with 50 seats or less
Second half of 2003	Aircraft registration criteria for non-scheduled air transport business raised from 50-seaters to 80-seaters
2009	Scheduled/non-scheduled air transport business → Domestic/international/small air transport business
March 2012	7 air transport business categories → diversified to 9 categories (business using ultralight aircraft, aircraft rental business)

Source: The Korea Transport Institute, Changes in Aviation Environment and Directions for Air Transport Policy (1st Stage), 2003.

2. Air Transport Business Licensing System

Licensing System Changes

The most important developments related to Korea's air transport business licensing system are the 1999 and 2009 amendments of the Aviation Act, as outlines in Table 2.9. The 1999 amendment featured a shift from a licensing system to a registration scheme for the non-scheduled air transport business. By easing market entry restrictions, the government aimed to promote the non-scheduled air transport business and strengthen the overall competitiveness of the nation's aviation sector. Through the 2009 amendment, the government reclassified the air transport business into three categories: domestic, international, and small air transport business. This was designed to promote international competitiveness of the nation's aviation industry by allowing air transport operators to pursue diversification based on their

Table 2.9 Changes in the air transport business licensing system

Year	Contents
1999	• Article 112: Scheduled air transport business (by route) → license system • Article 132: Non-scheduled air transport business → registration system
2009	• Article 112: Domestic/international air transport business → license system • Article 132: Small air transport business → registration system • Scheduled/non-scheduled air transport business by route → license system

business capabilities. Previously, the airline business had been classified into scheduled and non-scheduled sectors, thus causing confusion on the business scopes of the two categories.

Licensing System Legal Framework

The licensing system for domestic/international air transport business operators is based on Article 112 of the Aviation Act, with detailed requirements provided for by relevant decrees and enforcement regulations.

Table 2.10 Licensing requirements for domestic air transport business operators

Categories	Standards
1. Definition	Article 2-32 of the Aviation Act defines "domestic air transport business" as the air transport business of operating scheduled or non-scheduled domestic flights using aircraft, the size of which is not less than that prescribed by Ordinance of the Ministry of Land, Infrastructure and Transport
2. Capital	• Corporation: paid-in capital worth 5 billion won or more • Individual: asset evaluation amount of 7.5 billion won or more
3. Aircraft A. Number B. Capacity C. Seats	• 1 or more • instrument flight capacity, multi-engine aircraft, separation of the flight deck from the cabin or the cargo compartment, automatic location identification • 20 or more passenger seats per plane (except for international air cargo transport)

Table 2.11 Licensing requirements for international air transport business operators

Categories	Standards
1. Definition	Article 2-33 of the Aviation Act defines "international air transport business" as the air transport business of operating scheduled or non-scheduled international flights using aircraft, the size of which is not less than that prescribed by Ordinance of the Ministry of Land, Infrastructure and Transport
2. Capital	• Corporation: paid-in capital worth 15 billion won or more • Individual: asset evaluation amount of 20 billion won or more
3. Aircraft A. Number B. Capacity C. Seats	• 3 or more • instrument flight capacity, multi-engine aircraft, separation of the flight deck from the cabin, automatic location identification • 20 or more passenger seats per plane

Article 115-2 of the Aviation Act stipulates that an air transport business operator can commence the operation after obtaining the air operator certificate. The certificate is issued by the Minister of Land, Infrastructure and Transport after confirming that the operator has various elements in place to ensure the safety of aircraft operations, such as manpower, equipment, facilities, and support structure for operational and maintenance control, in accordance with the standards prescribed by the relevant ministry ordinance.

The licensing scheme for small air transport business is based on Article 132 of the Aviation Act. Detailed regulations are provided for in relevant enforcement decrees and regulations.

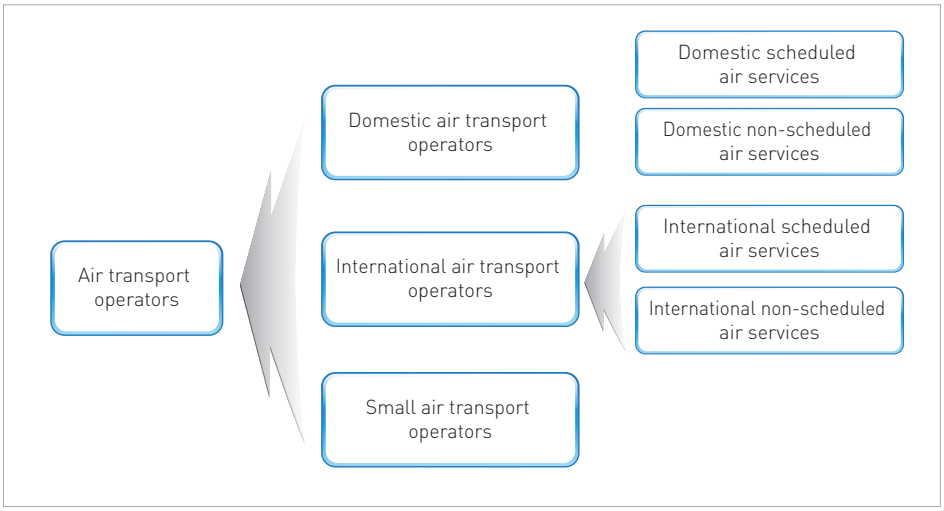
Table 2.12 Registration standards for small air transport business operators

Categories	Standards
1. Definition	Article 2-24 of the Aviation Act defines "small air transport business" as any air transport business, other than domestic air transport business and international air transport business
2. Capital	• Aircraft with 10 to 19 passenger seats Corporation: paid-in capital worth 2 billion won or more Individual: asset evaluation amount of 3 billion won or more • Aircraft with nine or fewer passenger seats Corporation: paid-in capital worth 1 billion won or more Individual: asset evaluation amount of 1.5 billion won or more
3. Technical staff A. Pilots B. Maintenance crew	• One or more certified airline transport pilots (commercial pilots in case the aircraft needs just one pilot in accordance with its flight manual) per aircraft • One or more certified aircraft maintenance mechanics per aircraft
3. Aircraft A. Number B. Capacity	• One or more • Automatic location identification (only for marine or international flight operations), instrument flight capacity
4. User convenience facilities such as waiting room	• Convenience facilities for users, such as waiting room and restroom (except for cases where such facilities are secured at the airport or airfield) • Information facilities for users
5. Insurance	Passenger insurance for every aircraft (except for cargo planes), aircraft insurance, cargo insurance, war insurance (only for international flight operations), third-party insurance, air crew insurance

Status of Aviation Market Entrance

Pursuant to the Aviation Act, Korea's flag-carrying airlines are classified as air transport business operators. The air transport business is classified into the categories of international, domestic and small air transport sectors. Article 2-31 of the Aviation Act defines "air transport business" as "commercial activity of transporting passengers or freight using aircraft in response to the

Figure 2.7 Classification of air transport business operators based on Aviation Act



demand of other persons."

As of February 2013, Korea has seven domestic and international air transport business operators: Korean Air, Asiana Airlines, Air Busan, Jeju Air, Jin Air, Eastar Jet, and T'way Airlines.

Table 2.13 Status of air transport business operators

Classification			2005	2006	2007	2008	2009	2010	Number of companies
International and domestic air transport operators	Full service carriers		Korean Air, Asiana Airlines						2
	Low Cost Carriers	Entry	Hansung Air, Jeju Air	-	Air Busan, Yeongnam Air	Jin Air, Eastar Jet	-	T'way Airlines (formerly Hansung Air)	5
		Exit	-	-	-	Hansung Air (suspension of operation)	Yeongnam Air	-	

Note: Entry and exit are based on minimum requirements for license authorization or revocation set by the Ministry of Land, Infrastructure and Transport.

Impacts of Licensing System Changes on the Air Transport Industry

Number of Business Operators

Low-cost carriers began to enter the market. The change in the licensing

system paved the way for establishing airlines with the capacity to provide a diversity of services.

Changes in Routes, Flight Frequency and Passenger Traffic

Full service carriers had been reducing the operation of domestic routes. In contrast, low-cost carriers increased flight frequency, mainly on routes to Jeju Island. This resulted in growth in domestic air passenger traffic. However, the increase was mostly concentrated on Jeju routes. Budget carriers also opened short-haul international routes and increased the flight frequency. These activities are having an impact on the growth of international passenger traffic as well.

Fare Changes

The new airlines offered highly discounted rates in their early stages of operation in an effort to attract customers. This strategy consequently led to a freeze of overall domestic airfares between 2004 and 2011. The low-cost carriers offered lower rates than existing airlines in the international passenger services sector as well, thus contributing to the promotion of overseas travel among Koreans.

Facilitating Overall Growth of the Aviation Sector

The newly created airlines bought various devices needed for aircraft operations. This helped facilitate the growth of the aircraft maintenance and components industries. The market entry of the budget carriers contributed to the creation of demand for air travel. By offering affordable fares and a diversity of services, the low-cost carriers provided a growing number of Koreans with opportunities to travel by air.

3. Airfare Policy

Changes in Airfare Systems[1]

International air transport operators should determine airfares or rates for certain routes as prescribed by pertinent aviation accords. They should file reports on fares with the Minister of Land, Infrastructure and Transport, and obtain authorization. Domestic air transport operators should, when they intend to determine fares, put up a public notice for at least 20 days in advance.

Changes in domestic airfare systems in Korea are outlined in Table 2.14. The government maintained an authorization system up until June 1992. Under the scheme, any moves to raise or alter air rates had to be reviewed by airlines, the aviation authority, and the Ministry of Finance and Economy. This was a period when the government strongly regulated airfare. In July 1992, the government introduced a new system, allowing airlines to file reports on fares with the relevant government authorities, instead of obtaining authorization. Initially, the fares were decided based on a distance-based scheme. In May 1993, the fares began to be determined on the basis of minimum fares (fixed cost) plus distance-based ones (changing cost). Introduced based on analysis of airlines' cost structure, this new fare scheme contributed to facilitating growth of the air transport industry. In February 1999, the government lifted restrictions on fares for domestic air services. The airlines introduced weekend fares and flexible rates. They were required to give public notice of fare changes at least 20 days prior to the implementation.

Table 2.14 Changes in domestic airfare schemes

Classification	Scheme	Contents
Before June 1992	Authorization system	• Review through airline → aviation authority → Ministry of Finance and Economy (later Ministry of Finance and Economy)
July 1992	Reporting system	• Application of a distance-based scheme as part of a policy to ease restrictions on domestic airfare
May 1993	Reporting system	• Minimum fare (fixed cost) + distance-based fare (changing cost) • Introduction of a fare scheme that reflected the airlines' cost structure
February 1999	20 days advance notice	• Fare liberalization led to introduction of weekend/weekday fares and flexible rates

1) The Korea Transport Institute, *A Study on Improving Airfare System*, May 2012.

Legal Grounds for the Airfare System

Provisions related to airfares are stipulated in Article 117 of the Aviation Act (Table 2.15).

Table 2.15 Legal grounds for airfare rates

Categories	Methods	Contents
International fares	Authorization and reporting	• Pursuant to Article 117-1 of the Aviation Act, each international air transport business operator should determine fares or rates for passengers or freight (excluding mail; hereinafter the same shall apply) of international air routes concerned as prescribed by aviation accords with respect to such international air routes and should either obtain authorization thereof from the Minister of Land, Infrastructure Transport or file a report thereof with the Minister of Land, Infrastructure and Transport
Domestic fares	Advanced public notice for at least 20 days	• Pursuant to Article 117-2 of the Aviation Act, each domestic air transport business operator should, when he/she intends to determine or alter fares or rates for passengers or freight of domestic air routes concerned, publish such determination or alteration in advance for not less than 20 days

Article 45 of the Enforcement Decree of the Aviation Act provides for the following criteria for airfare authorization:

- Not exceeding the range of reasonable expenses incurred in and profits from operation of relevant business
- Taking into consideration the nature of services furnished by the relevant business
- Not being unreasonably discriminatory against a specific passenger or freight consignor
- Not making it substantially difficult for a passenger or freight consignor to utilize relevant business
- Not invoking unreasonable competition with any other air transport business operator (referring to air transport business operators under Article 49-2-3 of the Act)

Analysis of Airfare Structure

The airfare usually has the following components: base fare, fuel surcharge, and tax (airport user charge). Base fares are divided into economy and

prestige class fares. Even within the same class, fares can differ depending on various elements such as discounts, flexible pricing, and peak time premiums. There are various discounts for children, elderly persons, soldiers, national meritorious persons, individual discounts, group discounts, internet discounts, and early bird discounts. Fuel surcharges are determined based on the surcharge calculation for domestic[2] and international routes[3] as well as multi-stage levying criteria.[4] For domestic flights, surcharges are determined by the average of fuel prices traded from the first day through the last day of the previous month. As for international routes, the surcharges for next month are determined by the average Mean of Platts Singapore trade price from the 16th of the previous month through the 15th of the current month. The most common tax related to air transport is the airport usage tax, which is levied according to specific criteria determined by nation and airport.

In the past, when making flight reservations or relevant inquiries, customers found it difficult to know the exact amount they would have to pay as they were shown only the base fare with other charges shown later. To address this issue the government introduced a full fare advertising rule in April 2012. The action was designed to help customers know the full price, including the fuel surcharge, when they purchase air tickets.

Impacts of Airfare Structure Change on the Aviation Industry

As far as the application of price differentiation policy is concerned, aviation performs better than any other mode such as road, railway, and marine transport. The air transport sector is implementing a diversity of price differentiation measures like peak time and off-peak time prices, discount fares for weekdays, route-specific flexible fares, discounts for children, the elderly and soldiers, group discounts, and online booking discounts.

2) Surcharges are determined by the average fuel prices traded from the first day through the last day of the previous month.
3) The criteria for determining fuel surcharges are based on the Mean of Platts Singapore.
4) There are 33 stages for levying surcharges. Currently, the levying is based on Stage 18.

In Korea, domestic air transport operators can alter domestic flight fares only if they give public notices on the change for a minimum of 20 days in advance. Under this system, the aviation authorities cannot exercise much influence on determining fares for domestic flights. Still, airfare increases are not affected much by commodity price hikes or the relationship between aviation authorities and the airlines.

It is necessary for airlines to take a more active stance on determining appropriate fare levels. Airlines need to act on their own, instead of expecting the government to provide them with guidelines related to airfare hikes. Under the current fare structure the government does not have effective policy options concerning domestic airfares, except for fuel surcharges.

There is a significant problem with the current 20-day public notice system for domestic flight fares as it serves more as a notice to competing airlines than as a notice to the public, consequently prompting the competitors to raise hikes as well. Causing such an effect is clearly against the interest of consumers.

4. Traffic Rights Allocation and Aviation Liberalization

Changes in the Traffic Rights Allocation Policy

Korea's traffic rights allocation policy has undergone multiple changes (Table 2.16). The government prepared Guidelines for Leading and Nurturing Scheduled Air Transport Operators in 1990 and Guidelines for Strengthening the Competitiveness of National Flag Carriers in 1994. In 1999, the Aviation Act was amended to create provisions on traffic rights and passage rights through foreign airspace. Thus, legal grounds were secured for the allocation of traffic rights, which had previously been implemented among air transport operators without a solid legal basis.

Table 2.16 Changes in traffic rights allocation policy

Year	Contents
October 1990	**Guidelines for Leading and Nurturing Scheduled Air Transport Operators** • In consideration of the status of Asiana Airlines as a newcomer, short to mid-haul routes to Southeast Asia were allocated between Asiana and Korean Air at a ratio of 2 to 1 • Criteria for allowing multiple airlines to serve the same destination: minimum of 150,000 passengers per year, for both short and mid/long-haul routes • Priority allocation was restricted to three times in the event of multiple airlines serving the same destination ※ Employing a separate management scheme for the two airlines, the government placed regional flight restrictions on Asiana. As compensation, Asiana was given priority in the allocation of traffic rights in regions the carrier was allowed to fly to.
August 1994	**Guidelines for strengthening the competitiveness of national flag carriers** • Removal of regional flight restrictions, equal distribution of new routes • Regional flight restrictions on Asiana were abolished, allowing it to pursue expansion of its international network without limits • Changes in criteria for allowing multiple airlines to serve the same destination → As for long-haul routes, five operations of B747-class aircraft a week (70% or higher load factor) or annual passenger demand exceeding 210,000 in number → As for mid to long-haul routes, operation of B767-class aircraft seven times a week (70% or higher load factor) or annual passenger demand exceeding 180,000 in number
2009	**Regulations on allocation of international air traffic rights and passage rights through foreign airspace** • Creation of Articles 118 and 118-2 of the Aviation Act to prepare legal grounds for the allocation of traffic rights and passage rights through foreign airspace

Legal Grounds for the Allocation of Traffic Rights and Passage Rights through Foreign Airspace

The allocation of traffic rights and the allocation of passage rights through

Table 2.17 Legal grounds for distribution of traffic rights and distribution of fly over right

Classification	Contents
Distribution of Traffic Rights, ETC. (Article 118 of the Aviation Act)	• The Minister of Land, Infrastructure and Transport may set aviation operation frequency through aviation conferences with foreign governments and allocate rights to the operation of aircraft (hereinafter referred to as "traffic rights") to international air transportation business operators within the limits of the frequency established, upon the request of such business operators. • The standards and methods for the allocation and withdrawal of traffic rights and other necessary matters shall be prescribed by Ordinance of the Ministry of Land, Infrastructure and Transport, taking into account the potential of air transportation business operators to render related services, the convenience of users, etc.
Distribution of Fly Over Right, ETC. (Article 118-2 of the Aviation Act)	• The Minister of Land, Infrastructure and Transport may set the frequency of passage through foreign airspace through aviation conferences with foreign governments and allocate rights to the operation of aircraft (hereinafter referred to as "passage rights through foreign airspace") to international air transportation business operators within the limits of the frequency so established, upon the request of such business operators. • The standards and methods for the allocation and withdrawal of passage rights through foreign airspace and other necessary matters shall be prescribed by Ordinance of the Ministry of Land, Infrastructure and Transport, taking into account the potential of air transportation business operators to render related services, convenience of users, etc.

foreign airspace are based on Article 118 and Article 118-2 of the Aviation Act, respectively.

Bilateral Air Services Accords and Agreements on Air Transport Liberalization

Table 2.18 outlines the major differences between bilateral aviation accords and agreements on the liberalization of international air transportation. Under bilateral accords, implementing matters related to route structure, exchange of traffic rights, flight frequency or supply capacity, and fares requires mutual consent of the two contracting governments. Whether to designate a single or multiple airlines should also be determined through negotiations between the two sides. In contrast, liberalization agreements place no restrictions on such matters as route structure, exchange of traffic rights, flight frequency or supply capacity, and fares.

Korea has signed bilateral air transport agreements with 94 countries (Table 2.19). European countries account for the largest number at 24.

Korea had pursued gradual liberalization of the aviation market, placing the utmost importance on protecting and nurturing the national flag-carrying airlines. Since 2000, however, it has actively promoted aviation agreements under the objective of ensuring the growth of national flag carriers through global network expansion and exploration of overseas markets. As of June 2015, Korea had air services agreements in place with 96 countries (Table

Table 2.18 Comparison of Bilateral Air Services Accord and Air Transport Liberalization Agreement

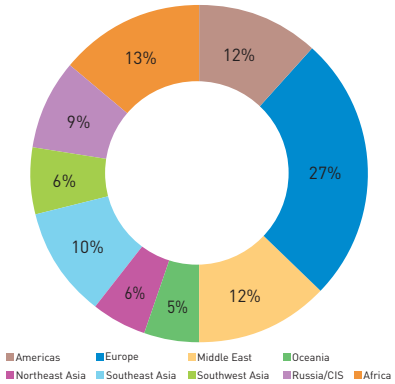
Categories	Bilateral Air Services Accord	Air Transport Liberalization Agreement
Route structure	Bilateral government consultations	No restrictions
Exchange of traffic Rights	Bilateral government consultations	Unlimited
Flight frequency or supply capacity	Bilateral government consultations	Unlimited
Fares	Subject to authorization	Freely set
Business collaboration	Mutual consent of the two governments	Allowed among up to three countries
Designation of airlines	Single or multiple	Multiple

Source: The Korea Transport Institute, *Changes in Aviation Environment in the 21st Century and Directions for Air Transport Policy (2nd Stage)*, 2004.

Table 2.19 Regional distribution of countries that signed air services accords with Korea

Regions	Contracting countries
Northeast Asia	6
Southeast Asia	10
Southwest Asia	6
Russia/CIS	9
Africa	12
Americas	11
Europe	26
Middle East	11
Oceania	5
Total	96

Source: Ministry of Foreign Affairs, Current State of Signing Agreement on Aviation, June 2015.



2.20). Eighty-five of the agreements provide for the designation of multiple airlines, while the remaining eight is based on a single carrier designation system.

The international air transport market is showing a trend oriented toward expanding market shares and intensifying the competitiveness of flag-carrying airlines through pursuing an open skies policy and building a single sky by region. Most prominently, integrated air transport markets are being built by EU countries, North American nations, and ASEAN+3 (Korea, Japan, China).[5] The Asian region is seeing moves to liberalize its air transport markets within the ASEAN+3 framework. The countries with which Korea has signed open skies agreements are listed in Table 2.21.

Impacts of Traffic Rights Allocation and Market Liberalization Policies on the Air Transport Industry

In the years prior to 2000, the Korean government maintained a passive stance on promoting aviation market liberalization. Beginning in 2000, it actively pursued a liberalization policy with a view to expand international

5) ASEAN has 10 members: Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam.

Table 2.20 Status of Korea's air services accords by region and country

Region	Multiple carriers system	Single carrier system
Americas (11)	U.S., Brazil, Mexico, Argentina, Canada, Chile, Peru, Ecuador, Paraguay, Panama, Colombia	-
Russia/CIS (9)	Russia, Uzbekistan, Kazakhstan, Kyrgyzstan, Ukraine, Azerbaijan, Belarus, Turkmenistan, Tajikistan	-
Southwest Asia (6)	India, Nepal, Pakistan, Sri Lanka	Bangladesh, Maldives
Northeast Asia (6)	China, Japan, Taiwan, Hong Kong, Macau, Mongolia	-
Southeast Asia (10)	Malaysia, Singapore, Vietnam, Indonesia, Thailand, Philippines, Brunei, Myanmar, Cambodia, Laos	-
Africa (12)	Kenya, Morocco, Algiers, South Africa, Sudan, Tunisia, Ethiopia, Seychelles	Djibouti, Gabon, Liberia, Nigeria
Oceania (5)	New Zealand, Australia, Fiji, Palau, Papua New Guinea	-
Europe (26)	U.K., France, Germany, Netherlands, Poland, Switzerland, Belgium, 3 Northern European countries (Sweden, Norway, Denmark), Austria, Spain, Czech Republic (successor to former Czechoslovakia), Hungary, Finland, Bulgaria, Malta, Romania, former Yugoslavia (nation dissolved and successor has not yet been decided), Portugal, Luxembourg, Iceland, Italy, Turkey, Greece, Croatia	-
Middle East (11)	UAE, Bahrain, Egypt, Iran, Oman, Qatar, Israel, Saudi Arabia	Iraq, Jordan, Kuwait
96	87	9

Note: As of June 2015.
Source: Ministry of Foreign Affairs, Current State of Signing Agreement on Aviation, June 2015.

Table 2.21 Countries that signed open skies agreements with Korea

Categories	Countries
Passengers and cargo (22)	Maldives (1986), Sri Lanka (1997), U.S. (1998), Chile (2001), Peru (2002), Kenya (2005), Thailand (2006), Vietnam (2006), China (2006, phased liberalization – Shandong Province, Hainan Island), Cambodia (2006, 2010 promotion), Myanmar (2006, 2010 promotion), Ukraine (2006, 2010 promotion), Azerbaijan (2006), Malaysia (2007), Japan (2007), Mexico (2008), Belarus (2009), Tunisia (2009), Ecuador (2009), Canada (2009), Paraguay (2012), Peru (2011)
Cargo (27)	Passenger (15 countries), India (1991), Austria (1996), Australia (1998), Three Northern European countries (2000), Germany (2001), Finland (2006), Greece (2007), Macau (2008), Uzbekistan (2008), South Africa (2008)

Note: Three Northern European countries include Sweden, Norway and Denmark.
Source: Ministry of Land, Infrastructure and Transport, 2012.

market shares and promote the growth of national flag carriers. In March 2000, the government finalized a plan for liberalizing air transport markets through establishing a phased implementation strategy. It is promoting aviation accords under a strategy to realize complete market liberalization through the following stages: increase in flights frequency → air cargo liberalization → 3rd and 4th liberalization of the passenger market → complete cargo and passenger liberalization. The government is actively pushing for liberalization accords with countries which are considered important in terms

of present or prospective air traffic demand, geographic or regional strategic significance, and the prospects of national flag carriers using them as regional hubs.

The government has paved the way for ensuring market entry of new airlines. Newcomers are facing the need to explore new markets based on a market diversification strategy. In order to ensure their growth in terms of both quality and quantity, they have to cultivate niche markets that have not been served by the existing airlines while trying to expand their international networks.

5. Antitrust Immunity[6]

Changes in Antitrust Immunity

Capital alliance among airlines began to decline in the late 1990s, giving way to "strategic alliance." This resulted in heated competition among alliance groups. In the 2000s, globalization made progress, leading to a rise in multilateral trade, with the World Trade Organization playing a central role. In the aviation sector, market liberalization was actively promoted based on multilateral or regional accords. Against this backdrop, the air transport industry saw ever intensifying competition among alliance groups over market shares.

Following the 1998 Korea-U.S. aviation agreement for market liberalization, Korea's two major airlines separately joined alliance groups, being awarded antitrust immunity by the U.S. government. Thus, they have gained benefits from the strategic alliance in relation to their operations in the U.S. market.

6) HONG Suk-jin, *A Study on the Application of Antitrust Immunity in the Domestic Air Transport Industry*, The Korea Transport Institute, 2004.

Table 2.22 Changes in antitrust immunity provisions

Classification	Contents
After February 1999	• Pursuant to Article 121 of the Aviation Act, agreements on air transport became subject to authorization
After June 2009	• Pursuant to Article 121 of the Aviation Act, agreements on air transport and alliances became subject to authorization

Legal Grounds for Antitrust Immunity

Provisions related to antitrust immunity are stipulated in Article 121 of the Aviation Act (Agreement, ETC. Pertaining to Transportation). These provisions provide that an air transport operator may conclude an agreement with other air transport operators as long as it does not practically restrict competition in the sector. The provisions also require that such an agreement should be authorized by the Minister of Land, Infrastructure and Transport.

Impacts of Antitrust Immunity on the Air Transport Industry

Generating the Effect of Lowering Airfares

According to Brueckner[7] (2003), the application of antitrust immunity has the effect of reducing airfares by 13-21%. He also asserted that the simultaneous application of antitrust immunity and code-share,[8] which have the characteristics of substitute goods, had been shown to generate the effect of lowering airfares by 17-30%.

Table 2.23 Legal grounds for antitrust immunity

Categories	Contents
Article 121 of the Aviation Act (Agreement, ETC. Pertaining to Transportation)	• Where a domestic air transport business operator or an international air transport business operator intends to conclude an agreement on air transport, including any joint operation agreement, with any other air transport business operator or to conclude an agreement on business cooperation or other alliance in regard to flight schedules, fares, public information or sales, he/she shall obtain the authorization of the Minister of Land, Infrastructure and Transport • Any of the following matters shall not be included in transport or alliance agreements: - Matters related to practical restrictions on competition among air transport business operators - Matters related to unjust infringement on customers' benefit or discrimination against a particular customer - Matters related to unjust restrictions on obtaining or withdrawing from membership in such agreement

Improving the Competitiveness of Airlines

Antitrust immunity helps national flag-carrying airlines promote cooperation among themselves so that they can increase efficiency in the operation of low-demand domestic routes. On international routes it helps them form strategic alliances with foreign carriers, thereby maintaining their operational efficiency, securing economies of scale, and ultimately improving their competitiveness. However, there is a precondition for granting antitrust immunity: it should not undermine the benefits of air transport users.

Table 2.24 Effects of the application of antitrust immunity

Factors	Effects
Joint price adjustment	• Joint sales possible • Forming optimum market prices • Using joint sales networks and sales staff • Joint advertisement and promotion
Opportunities for joint activity within alliance groups	• Formulating optimum schedules • A rise in commission through joint deals with card companies

6. Air Transport Services

Air Transport Market Participation

New Carriers' Market Participation

With the entry of low-cost carriers (LCC)[9] in 2005, Korea's aviation market was transformed into a competitive structure with multiple airlines. A market-based mechanism has since been rapidly established, bringing about various changes including diversification of air routes, fares and services. Korean LCC are facing heated competition on international routes because of the increase in flights to Korea served by other Asian budget carriers such as AirAsia and Peach Aviation. Such a competitive system has contributed to

7) Brueckner, J.k, "International Airfares in the Age of Alliance: The Effects of Codesharing and Antitrust Immunity," *The Review of Economics an d Statistics*, 85(1): pp.105~1088, Feb. 2003.
8) Code-share alone would generate the effect of lowering airfares by 8-17%.
9) Jeju Air, Jin Air, Air Busan, Eastar Jet, T'way Airlines.

continuous growth in air traffic in Korea.

In 2012, the number of passengers carried by the nation's airlines on domestic routes reached 22,485,017, representing an increase of 11.1% or 1,859,671 passengers from the previous year. LCC domestic market share kept rising from 33.95% in 2010 to 41.35% in 2011 and 43.8% in 2012.

On international routes, Korean air carriers transported 31,955,075 passengers in 2012, up 16.8% from the previous year. All national flag-carrying airlines are currently operating international routes. T'way Airlines, which launched their route to Bangkok on October 14, 2011, was the last to

Table 2.25 Domestic passenger transport statistics

Categories	2010		2011		2012	
	Flight operations	Passengers	Flight operations	Passengers	Flight operations	Passengers
Korean Air	57,286	8,726,515	54,202	7,767,712	56,884	7,675,324
Asiana Airlines	33,887	4,370,427	33,313	4,329,094	34,226	4,619,157
Jeju Air	17,764	1,963,592	17,330	2,085,827	17,543	2,170,528
Jin Air	12,208	1,602,087	12,016	1,521,212	12,642	1,644,113
Air Busan	10,751	1,648,456	13,299	2,275,310	15,712	2,675,638
Eastar Jet	8,360	1,363,044	8,105	1,287,271	9,188	1,529,729
T'way Airlines	1,642	154,399	8,948	1,358,920	9,412	1,582,486
Total	141,898	19,828,520	147,213	20,625,346	155,607	21,896,975

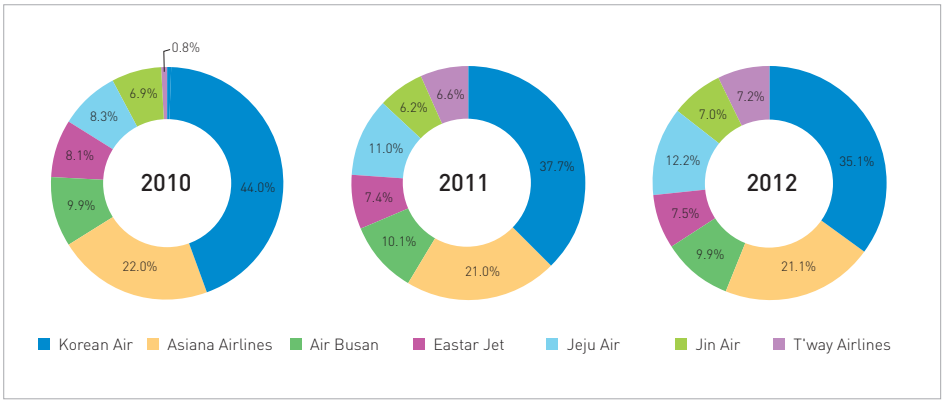
Note: Domestic routes (departure), flight operations (passenger planes, scheduled services), passengers (including infants and preschool children).
Sources: Aviation Statistics, Korea Airports Corporation.

Table 2.26 International passenger transport statistics

Categories	2010		2011		2012	
	Flight operations	Passengers	Flight operations	Passengers	Flight operations	Passengers
Korean Air	74,352	15,062,838	79,098	15,463,664	89,704	17,060,041
Asiana Airlines	57,389	10,124,728	60,266	10,227,045	66,976	11,291,074
Jeju Air	1,068	129,524	3,074	405,577	4,624	614,074
Jin Air	170	20,998	942	101,284	4,972	633,228
Air Busan	3,119	454,329	5,102	764,276	8,312	1,204,728
Eastar Jet	1,341	182,412	2,891	377,711	5,819	820,152
T'way Airlines	0	0	169	18,677	2,683	331,778
Total	137,439	25,974,829	151,542	27,358,234	183,090	31,955,075

Note: International routes (departure and arrival), flight operations (passenger planes, scheduled services), passengers (including infants and preschool children).
Sources: Aviation Statistics, Korea Airports Corporation.

Figure 2.8 Low-cost carriers' domestic market shares by year



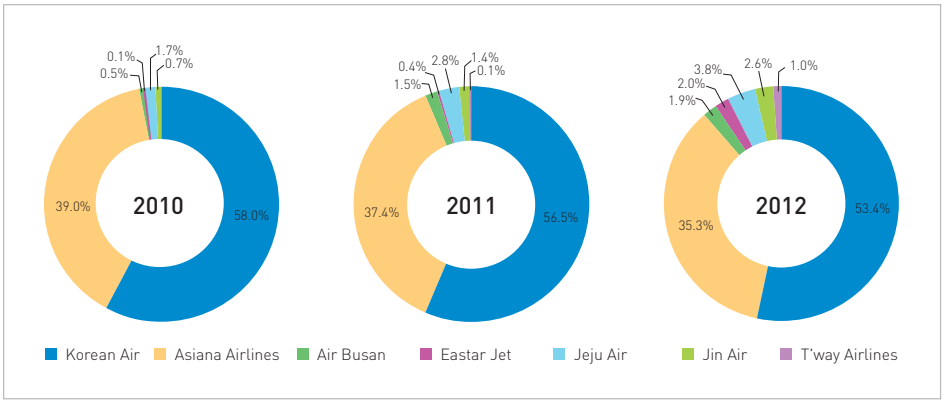
join the Korean carriers serving international destinations. LCC shares for international flights increased from 3.03% in 2010 to 6.10% in 2011 and 11.2% in 2012.

Improvement in income levels led to behavioral changes among Koreans in relation to air travel. They began to use air transport more actively while demanding better services leading to impacts on the government's aviation polices. The government responded by placing the interests of air transport users above those of airlines.

The market entry of budget carriers and the continuous increase in air traffic users have led to a considerable rise in damages claims and complaints. However, appropriate policy measures have yet to be established to address the problem. A growing number of aviation complaints are referred to the Consumer Protection Agency, but the agency is experiencing difficulties dealing with the situation due to the lack of pertinent regulations on remedies for delayed or cancelled flights.

In a related development, the government is pursuing an airport advancement policy, which would include the introduction of a new operational scheme. The nation's airports have been under operational jurisdiction of two government invested airport corporations since the opening of Incheon International Airport in 2001. One contemplated measure is over their privatization. There has been concern that the operation

Figure 2.9 National flag-carrying airlines' shares for international flights by year



of airports by private-sector companies might lead to a reduction in service quality and user satisfaction levels. To remove said quality concerns, the government is implementing inspections on the nation's air transport operators to evaluate their service quality levels, pursuant to Article 192-3 of the Aviation Act. The inspections are designed to continuously improve the level of air traffic services and protect the rights of air traffic users.

Remedy for Damage Associated with Air Traffic Services

- **Consumer Policy and Related Laws**

The Consumer Protection Act was enacted in 1980 and the government-affiliated Consumer Protection Agency was founded seven years later. The following laws were created for the protection of consumers: Consumer Protection Act (1980), Regulation of Standardized Contracts Act (1986), Monopoly Regulation and Fair Trade Act (1990), Installment Transactions Act (1991), the Door-to-Door Sales, ETC. Act (1991), and the Product Liability Act (1999).

- **Consumer Protection Laws**

Korea enacted the Consumer Protection Act in 1980 and the Enforcement Decree of the Act followed in 1982. Pursuant to the law, the Consumer Policy

Deliberation Committee was formed for the establishment of basic directions for consumer protection. The committee was chaired by the Minister of Finance and Economy.

In 2006, the Consumer Protection Act was wholly amended and renamed the Framework Act on Consumers. It signified a policy change aimed at enhancing "consumer rights" instead of only ensuring "consumer protection." The new stance led to a multitude of changes in the consumer policy implementation structure. The government has formulated mid to long-range policy measures to enhance consumers' rights based on basic policy directions and strategies established between 2006 and 2010. The Framework Act stipulates the fundamental rights consumers have. On the basis of this Act, it can be stated that consumers using air traffic services have the right to have their lives, bodies, and property protected against any danger or injury caused by said services.

- **Laws Related to Air Transport Users**

The Aviation Act has no provisions directly stipulating the protection of air transport consumers. The only related provision is Article 119 of the Act (Keeping of Transport Clause, ETC.), which briefly states where the transport contract clauses related to flight delays, cancellations, baggage claims and ticket refunds should be located.

Article 36 of the Aviation Safety and Security Act (Compensation for Loss Caused by Use of Airplane) stipulates that passengers may file for remedies for damage associated with the use of aircraft, pursuant to the Framework Act on Consumers. The law provides that air carriers should establish and maintain a filing office to receive remedy applications. Air carriers are required to forward remedy applications to the Korea Consumer Agency and notify the applicants of the fact within eight days after receipt of application.

These legal provisions have paved the way for handling air traffic consumers' complaints at the consumer agency. However, this system is not extensively utilized due to procedural complexity.

Damage Associated with Air Traffic Services

In 2012, the Korea Consumer Agency provided consulting services for 2,931 cases involving air traffic users. The number represented a 2.4-fold increase from 2007. The number of remedy applications the agency actually received in 2012 was 396, up 2.7 times compared with 2007. These statistics show that remedy applications increased at a higher rate than consultations.

In 2012, flight delays occurred 16,992 times, which accounted for 5.02% of total flights. Cancellations took place 3,188 times, or 0.94% of total flights.

Implementation of the Air Transport User Protection System

New provisions of the Aviation Act were established through partial amendment of the Act in December 2011. The contents of the newly created provisions are as follows:

Establishment of Remedy Procedures and Damage Settlement Plans

In order to ensure the protection of air transport users, air transport operators should establish damage settlement plans that include the following contents:

1. Air carriers' breach of transport contracts and delayed implementation
2. Lost and damaged baggage
3. Overbooking
4. Delay in refunding tickets
5. Boarding failure due to non-supply of relevant information, ex: boarding gate, flight number, etc.
6. Matters prescribed by a Ministry of Land, Infrastructure and Transport decree for the protection of air transport users, other than those mentioned in Paragraphs 1~5

In addition, air transport operators should see to it that damage remedy plans include the following matters:

Table 2.27 Korea Consumer Agency statistics on consulting services and remedy applications

Categories	2007	2008	2009	2010	2011	2012	Total
Total flights (1,000) (A)	386	390	379	404	433	469	2,467
Consulting services (B)	1,201	1,886	2,218	1,597	2,353	2,931	12,186
Year-on-year growth	-	57.0	17.6	-28.0	47.3	24.6	-
Consulting services/ total flights (B/A)	0.31	0.48	0.59	0.40	0.54	0.62	0.49
Complaints received (C)	148	225	309	141	254	396	1,473
Year-on-year growth	-	52.0	37.3	-54.4	80.1	55.9	-
Complaints received/ total flights (C/A)	0.04	0.06	0.08	0.03	0.06	0.08	0.06

Note: These statistics cover all carriers, national flag-carrying airlines and foreign airlines serving Korea.
Source: Status of remedy applications received was provided by the Korea Consumer Agency.

Table 2.28 Causation analysis of flight delays and cancellations

Categories	Total flights	Weather	Maintenance	Connection	Other (imputable)	Other (absolvable)	Total	Ratio
Delayed flights	20,180	969	639	11,421	308	3,655	16,992	5.02%
Cancelled flights		2,276	133	698	20	61	3,188	0.94%

Note: Total flights (passenger plane) = international routes (departure and arrival), domestic routes (departure).
Source: Aviation Statistics, Korea Airports Corporation.

1. Matters related to the establishment and maintenance of a remedy application filing office
2. The roles and duties of each department and staff members in charge of remedy affairs
3. Remedy application handling procedures
4. Information service on application processing results

Service Evaluation for Air Transport Operators

Pursuant to the Aviation Act, the Minister of Land, Infrastructure and Transport should evaluate the quality of air transport services and publish the results. The evaluation should be conducted after analysis of the results of various surveys and research implemented by air transport operators: surveys on air traffic service status, case studies on consumer damages, on-site investigation, and user satisfaction questionnaire surveys. The service

evaluation covers reliability, safety, damage remedy, and user satisfaction levels. The following business operators are subject to the evaluation:

- Seven airlines: Korean Air, Asiana Airlines, Jeju Air, Jin Air, Eastar Jet, Air Busan, T'way Airlines
- Five airports: Incheon, Gimpo, Jeju, Gimhae, Cheongju airports
- Foreign-based air carriers (Top 5 Full Service Carrier (FSC) and 4 Low Cost Carrier (LCC) operating flights to Korea, selected based on traffic performance)

Deficiencies of national flag-carrying airlines are identified through comparison with foreign-based carriers. The findings are presented to pertinent carriers for improvement.

Publication of the Air Transport User Report

The air transport user report provides reliable and useful information on aviation. Made based on the characteristics of airport-specific carriers and passengers, the report contains the following information:

1. Status of air transport operators and users
2. Air transport users' damage status and related analysis data
3. Matters related to air transport service levels
4. Information on the safety level of air transport operators based on Article 112-2 of the Aviation Act
5. Matters related to user protection and service policies of international organizations or other countries
6. Matters prescribed by a Ministry of Land, Infrastructure and Transport decree for the protection of air transport users, other than those mentioned in Paragraphs 1-5

Achievements and Lessons

Although it is a bit early to talk about achievements, a proactive policy is being implemented for the protection of the rights of air transport users.

Figure 2.10 Air transport user report

Most prominently, air carriers' service levels are evaluated in accordance with the Air Transport Service Evaluation provision, which was newly established in the Aviation Act in July 2012. The evaluation is conducted using airline-provided data obtained through status surveys, case studies concerning user damage, on-site investigations, and surveys on user satisfaction levels.

Problems and deficiencies identified through the evaluation are presented to the government and air carriers so that they can be used as basic material in formulating policies and ensuring continuous and autonomous improvement of the quality of services. This policy aims to ensure the supply of advanced air traffic services, thereby addressing problems related to user complaints. It will also aid in establishing consumer protection measures in a manner suitable for the nation.

Implementation of the air transport user protection system makes it possible to cope with consumer damage in a more expeditious and efficient manner, thus enhancing the level of carrier services. In addition, objective and reliable results obtained from the service evaluation can contribute to promoting a healthy competitive relationship among airlines. Publication of the user report data is designed to regularly provide reliable and useful information to air transport users, thus creating an environment for helping consumers make their own informed choices.

Section 3

Significance and Implications

Relaxing of air transport licensing restrictions led to the market entry of five new airlines. This promoted competition among air carriers, eventually helping to provide more affordable fares and better services to air transport users. By diversifying marketing strategies and expanding business scope, the air carriers also could enhance their competitiveness.

In 2012, the government introduced a full fare advertising rule, which requires that airlines state the full fare amount, including the base fare and fuel surcharge when selling tickets. The action was to address consumer complaints caused by the practice of airlines showing only the base fare to customers. The practice made it difficult for customers to know the exact amount they would actually have to pay.

In a sense, air services agreements conflict with promoting air transport liberalization. Air services accords are designed to operate international routes under rules agreed on between nations. In contrast, the liberalization of air transport is aimed at ensuring the operation of international routes without restrictions. A growing number of countries are working to speed up liberalization in the aviation sector. Still, some countries are adopting air services agreements that are restricted in their capacity and scope of

application in order to protect their flag-carrying airlines.

With regard to air services agreements, Korea faces various problems, such as the allocation of routes between existing carriers and the new airliners as well as flight restrictions on Gimpo Airport. The government needs to develop new policies that can enhance the competitiveness of national flag carriers and restore the vitality of regional airports.

Antitrust immunity promotes strategic alliance among air carriers, thus helping to ensure their efficient operation and generate the effect of lowering airfares. The government should judiciously grant antitrust immunity to airlines as long as it would not undermine consumer benefits or discriminate against other airlines.

Globally, there is a growing trend toward strengthening measures to protect the rights of air transport users. Keeping up with this trend, Korea introduced a full-fledged air transport user protection system in 2012, and began implementing an evaluation of air traffic services. This system is expected to help reduce the issues that air transport users suffer and enhance the quality of air carrier services.

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Chapter
03

Airport Infrastructure Development and Policy Directions

Section 1

Domestic Airport Development Process

With expansion in the national economy, Korean airports have achieved phenomenal growth since the 1980s. Since 1994, the Korean government has implemented a series of basic plans designed to ensure mid and long-term development of airports in a systematic and efficient manner. The fourth basic plan is currently underway. The nation's airport history dates back to 1916, when an airfield was established in Yeouido, Seoul. In 1958, the airfield's civil aviation service functions were transferred to Gimpo International Airport under a presidential decree. In 1971, Gimpo Airport began to function as a full-fledged international airport. In the 1980s, the nation saw a rapid rise in air traffic demand, which was caused by a combination of factors such as economic growth, the 1988 Seoul Olympics, and the 1989 liberalization of overseas travel. Even with facility expansion, the airports could not keep up with the growing demand. Ultimately, Gimpo Airport, which was the only airport in the Seoul metropolitan area, reached its capacity limit. This prompted the government to push actively for the construction of a new airport. With the prospects of future growth in mind, the government devised a plan to build a new airport on reclaimed land joining Yeongjong, Yongyu, Sammok and Sinbul islands into one landmass. The project was implemented

successfully, leading to the opening of Incheon International Airport on March 29, 2001. The government's strong determination and devotion shown by the people are the most crucial elements needed for the development of an airport. An airport development project should also be backed by a pertinent legal framework. Incheon International Airport has now established itself as an internationally acclaimed airport hub.

In the meantime, the demand for inland air traffic services has continued to decrease due to the expansion of roads and railway networks. As a result, many airport facilities have been made redundant, reduced to serving as examples of excessive investment. This should serve as a notice that airport development must be based on a plan that can ensure harmony between air transport and other modes of transport. This paper reviews Korea's airport development experience for the purpose of sharing it with developing countries, eventually helping them to develop the capacity to use airports as a major driver for their economic growth.

1. After National Liberation in 1945 (Introductory Stage, 1950s - 1970s)

The nation's first airfield was a small military airstrip that opened in Yeouido in October 1916 and was operated by the Japanese colonial army. After the liberation of Korea from Japanese rule in 1945, the U.S. Army Military Government and the Air Force took operational control of most airfields in the nation. In 1961, the Ministry of Transport gained administrative jurisdiction over the airfields marking the beginning of efforts to develop full-scale civilian airports in the nation.

In 1948, a Korean business tycoon named SHIN Yong-wook established Korean National Airlines, the nation's first airline company, entirely with private capital. The company began serving the Seoul-Busan route on October 1 of that year. It was followed by the operation of air flight services between Seoul and various other cities including Gangneung, Gwangju, Jeju

and Ongjin.

The Ministry of Transport took over Gimpo Airport from the Air Force in 1961 and opened Daegu Airport on July 4, 1961 and Busan International Airport on September 3, 1963 which was upgraded from Busan Airfield. It initiated civil aircraft operation at Gangneung Airport in December 1967, opened Jeju International Airport on September 3, 1963 as an upgrade from Jeju Airfield, and launched civil air flight services at Sokcho Airport from May 1968. The next decade saw the opening of Sacheon, Mokpo and Pohang airfields on February 13, 1970, Ulsan Airfield on October 23, 1970, Yeosu Airfield on July 5, 1972, and Gimhae International Airport was opened when Busan International Airport moved to Gimhae on October 14, 1976.

2. Opening and Growth of Gimpo International Airport (Growth Stage, 1970s - 1990s)

Gimpo International Airport opened as the nation's main international airport on January 27, 1958, when Yeouido International Airport's functions were transferred to Gimpo. During the initial year, the airport's international and domestic passenger traffic reached just 22,000 and 56,000, respectively. The airport has since achieved astronomical growth with 4.09 million international passengers and 15.33 million domestic passengers in 2012. It recorded its peak performance in 1997, when the passenger traffic amounted to 21.27 million for international flights and 15.22 million for domestic services. In order to better cope with increasing demand for air traffic services in the Seoul metropolitan area, it transferred a majority of its international service functions to Incheon International Airport that opened on March 29, 2001.

Gimpo International Airport facilitated the dispatch of Korean construction workers overseas during the Middle Eastern construction boom in the mid-1970s. During the 1980s, it played a crucial role in ensuring the successful staging of the 1986 Asian Games and the 1988 Seoul Olympics.

In May 1980, the government established the International Airport Authority, a public enterprise specializing in airport operation. Shortly after its inauguration it took over operational control of Gimpo Airport. The authority then took charge of the management of Gimhae International Airport on May 16, 1983 and Jeju International Airport in September 1985. On February 6, 1990, Yecheon Airfield opened. On June 21, 1990, operational control of all local airports was transferred to the authority which was renamed Korea Airports Authority and eventually Korea Airports Corporation.

Commercial air services began at Gunsan Airport in December 1992, Wonju Airport in February 1997, and Cheongju International Airport in April 1997. These developments led to the completion of a full-fledged network of local airports. Aviation market expansion in the 1980s brought about a significant change in the domestic airline industry. In 1988, Seoul Air Co. (later renamed Asiana Airlines) was founded. This put an end to Korean Air's monopoly on the nation's airline industry, ushering the nation into an era of multiple carriers.

3. Opening of Incheon International Airport (Leap Forward Stage, 2000 - Present)

Beginning in the 1980s, the nation had discussions on the need to build a new airport in the nation's capital region in order to address the problem of Gimpo's capacity saturation. With the selection of Yeongjong Island as the site for the new airport, preparations for building Incheon International Airport began in earnest. The process of drawing a basic design started on November 16, 1990. The ground-breaking ceremony took place on November 12, 1992, signaling the start of new airport construction. The mud flat between the islands turned into steady ground through reclamation and soil improvement processes following sea wall construction over two years. Construction of the passenger terminal started in May 1996 and runway construction began on

January 12, 1997. The basic facilities for airport operation were completed on June 30, 2000. After comprehensive test operation, the airport opened on March 29, 2001. Its construction took eight years with an annual workforce of 14 million people and a total cost of 5.632 trillion won. After opening, service capacity soon became saturated due to the increase of air traffic demand. In response Phase 2 construction began in order to prevent the lowering of service quality with completion in June 2008. The total project cost amounted to 3.9 trillion won (excluding private capital).

With the completion of Phase 1, Incheon International Airport became one of the world's most favored airports as well as a Northeast Asian logistics hub. With Phase 2, the airport positioned itself as the best airport in the world in every aspect, including service and facility. The airport was ranked 1st in global airport service assessment consecutively from 2005 through 2012. It was also placed among global top five in the category of international cargo and top 10 in the international passenger category. In 2006, Incheon was awarded the Asia-Pacific region's best airport award for airport efficiency by the World Aviation Transport Society and selected as the world's best airport by TIME (Asia edition), Official Airline Guide, and Center for Asia Pacific Aviation. It was also chosen as the world's best airport by Global Traveler for two years in a row (2006-2007) and the best cargo airport in the world by Air Cargo World. Not resting on its laurels, Incheon International Airport is making every effort to create new values in order to secure its position as a leading hub airport among serious competition.

In order to further solidify its position as the Northeast Asian hub airport, Incheon International Airport is implementing Phase 3. The project started in 2009 with opening set for 2017, with total construction costs of 4.930 trillion won. The project includes construction of a second passenger terminal to the north of the present one and the building of a railway connecting the two terminals.

Section 2

Airport Development Execution System

1. Airport Development Plan

In order to ensure effective implementation of airport development projects, the government (Ministry of Land, Infrastructure and Transport) formulated the Basic Plan for Airport Development in 1994, formally announcing it on April 19 of that year. As a statutory plan established pursuant to the Aviation Act, it provides guidelines for state funding of airport development projects as well as formulation of master plans for each airport.

Major Contents of the Comprehensive Plan for Mid to Long-Term Airport Development

The Comprehensive Plan for Mid to Long-Term Airport Development is a low-tier plan formulated based on Article 2 of the Aviation Act in relation to state aviation policy. It is also the highest-echelon plan formulated pursuant to Article 89 of the Aviation Act in the category of airports. Its history goes back to 1994 when the Basic Plan for Airport Development (later renamed Comprehensive Plan for Mid to Long-Term Airport Development) was

established. Its fourth plan is currently under implementation.

- First Basic Plan for Airport Development: announced April 19, 1994
- Second Basic Plan for Airport Development: announced December 30, 2000
- Third Comprehensive Plan for Mid to Long-Term Airport Development: announced November 24, 2006
- Fourth Comprehensive Plan for Mid to Long-Term Airport Development: announced January 5, 2011

The first plan was designed to establish a framework for airport development in a way that could cope with rapid growth of the aviation industry. The second plan was related to the active implementation of airport expansion and development projects. This period, however, saw delays in various relevant projects as well as changes in aviation environments at home and abroad. It would have been advantageous if the government readjusted the airport development plans by considering changes in domestic and international aviation markets. The third plan was formulated and executed without significant changes being made to the airport development framework. Nearly all the projects were completed with only a few cancelled resulting in an oversupply of facilities for provincial airports. However, international service facilities were appropriately expanded to meet the growing demand through consecutive implementation of the plans. Consequently, the fourth plan contained few expansion programs for provincial airports focusing instead on promoting effective utilization of the expanded facilities.

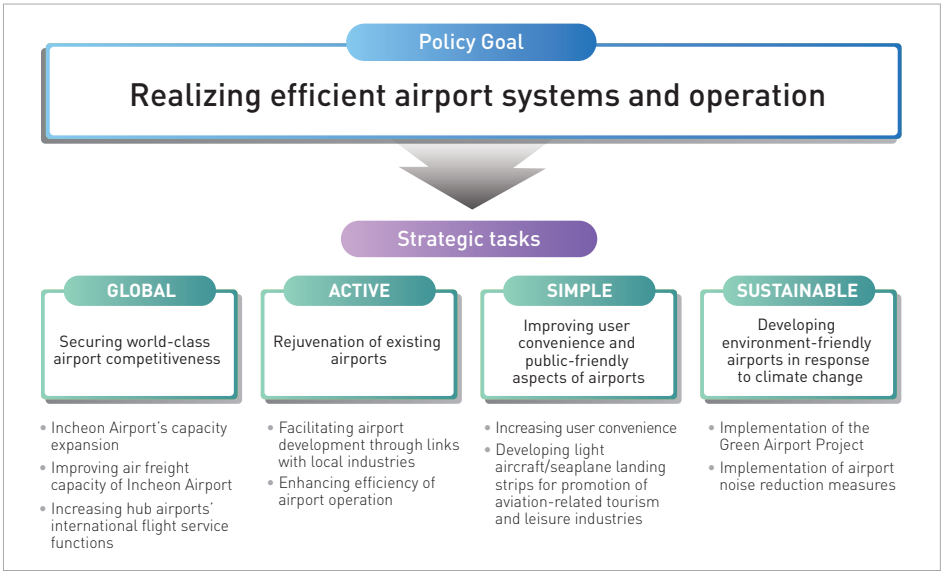
Major Contents of the Fourth Comprehensive Plan for Mid to Long-Term Airport Development

The Fourth Comprehensive Plan for Mid to Long-Term Airport Development covers the five year period from 2011 to 2015. With its basic directions oriented toward realizing efficient airport systems and operation, the plan

calls for implementation of four strategic tasks. The first task is to secure world-class competitiveness of airports. Specifically, it envisions "expanding the capacity of Incheon International Airport," "strengthening air cargo handling functions of Incheon International Airport" and "increasing international flight service functions of hub airports." The second task is to facilitate the "rejuvenation of the existing airports" through efforts to increase efficiency of airport development and operation by strengthening links between airports and local industries. The third task is to "reinforce user convenience and public-friendly aspects of airports." It specifically aims for the development of air strips for light aircraft in an effort to increase user convenience and promote people-friendly aviation and leisure industries. Lastly, the plan emphasizes the need to "develop environment-friendly airports in response to climate change." Realizing this task requires consistent implementation of green airport and airport noise reduction programs.

As for zonal division in relation to airport development, the plan follows

Figure 3.1 Policy goal and strategic tasks of the 4th Comprehensive Plan for Mid to Long-Term Airport Development



Source: Ministry of Land, Transport and Maritime Affairs, Fourth Comprehensive Plan for Mid to Long-Term Airport Development (2011-2015), put on public notice on January 5, 2011.

the traditional scheme of dividing the nation into four zones: the Central Zone, Southwest Zone, Southeast Zone and Jeju Zone. Zonal division is based on airports' sphere of influence.

- Central: Seoul, Incheon, Gyeonggi Province, Gangwon Province, Daejeon, North Chungcheong Province, South Chungcheong Province
- Southwest: Gwangju, North Jeolla Province, South Jeolla Province
- Southeast: Busan, Daegu, Ulsan, North Gyeongsang Province, South Gyeongsang Province
- Jeju: Jeju Special Self-Governing Province

The plan retains the existing hierarchical scheme of classifying the nation's airports into three categories: hub airports, main airports, and general airports. However, it reduced the number of main airports to six, based on the "selection and concentration" strategy. Under the plan, the hub airport represents Korea in the global aviation market. Main airports support international exchanges of zones by actively coping with demand for international flights, in addition to handling demand for domestic flight services in each zone. General airports are in charge of handling small demand that arises in the provincial areas. The plan also introduced the concept of small airports that are smaller in size than general airports. These airports are intended to handle demand for flights to islands or remote areas. Ulleung and Heuksan islands are referred to as first candidate locations. The basic plans for building small airports on these islands are to be established in 2015.

Figure 3.2 Zonal division of Korea

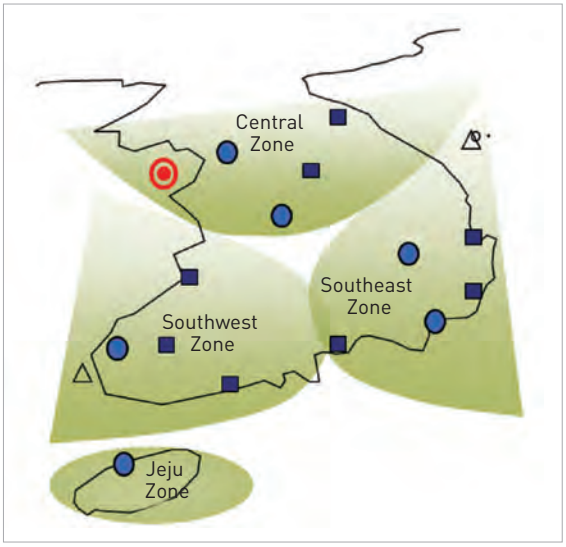


Table 3.1 Hierarchy of airports and their functions

Classification	Characteristics	Pertinent airports	Functions
Hub airport	Representing Korea in the global aviation market	Incheon	• A hub in Northeast Asia, targeting the global aviation market
Main airport	Handling domestic and international air traffic demand at each zone	Gimpo, Cheongju, Muan, Gimhae, Daegu, Jeju	• Handling demand for domestic trunk air routes as well as short and medium-haul international routes (Attracting some long-haul routes, depending on demand)
General airport	Handling small regional demand	Wonju, Yangyang, Gwangju, Yeosu, Gunsan, Ulsan, Pohang, Sacheon	• Meeting provincial city-based demand for domestic and some international flights
Small airport	Smaller than general airports in size	Ulleung Island Heuksan Island	• Providing aviation services to islands and remote areas

Table 3.2 Distribution of airports by zone

Categories	Central Zone	Southeast Zone	Southwest Zone	Jeju Zone
Hub airport	Incheon Airport			
Main airport	Gimpo Airport Cheongju Airport	Gimhae Airport Daegu Airport	Muan Airport	Jeju Airport
General airport	Wonju Airport Yangyang Airport	Ulsan Airport Pohang Airport Sacheon Airport	Gwangju Airport Yeosu Airport Gunsan Airport	
Small airport		Ulleung Island	Heuksan Island	

* To be implemented following feasibility studies to be conducted in 2013.

2. Airport Development and Operation System

Airport Development and Operation

Airport Development

Ever since the Aviation Division was set up under the Transport Ministry's Transport Bureau in 1948, airport development projects have been led by the state. Currently, the Ministry of Land, Infrastructure and Transport has administrative jurisdiction over airport-related affairs. Recently the private sector's participation in airport construction has increased significantly. For example, the fueling facilities and cargo terminal of Incheon International

Table 3.3 Airport development project implementation procedures

Establishment of Mid to Long-Term Master Plan for Airport Development (Ministry of Land, Transport and Maritime Affairs)	• Article 89 of the Aviation Act - Consultation with head of relevant central administrative organizations	→ All airports
↓		
Publication Announcement of Master Plan, ETC. (Ministry of Land, Transport and Maritime Affairs)	• Article 91 of the Aviation Act - Publication of the plan in the Government Gazette	
↓		
Establishment (amendment) of Basic Plan for Airport Development (Ministry of Land, Transport and Maritime Affairs)	• Articles 89 and 90 of the Aviation Act - Consultation with head of relevant central administrative organizations	
↓		
Publication Announcement of Master Plan, ETC. (Ministry of Land, Transport and Maritime Affairs)	• Article 91 of the Aviation Act - Publication of the plan in the Government Gazette	
↓		
Formulation, Approval, ETC. of Implementation Plans (Regional Aviation Administration)	• Article 95 of the Aviation Act - Consultation with head of relevant administrative organizations	
↓		
Compensation for land and obstructions (Regional Aviation Administration)	• Act on Appropriation of and Compensation for Land for Public Projects (January 2003) ※ Delegated mostly to regional autonomous governments	→ Individual airports
↓		
Bidding, contracting, project supervision (Regional Aviation Administration)	• Legal provisions regarding contracts involving the state ※ Public procurement service contracts worth 3 billion won or more (Procurement Projects Act)	
↓		
Project completion and inspection (Regional Aviation Administration)	• Legal provisions regarding contracts involving the state	
↓		
Inspection of Installation Completion of Airfield and Navigation Safety Facilities (Regional Aviation Administration)	• Article 77 of the Aviation Act	

Note: Ministry of Land, Transport and Maritime Affairs was renamed as the Ministry of Land, Infrastructure and Transport in 2013 with the inauguration of the PARK Geun-hye administration.
Source: Board of Audit and Inspection, A Report on the Status of Airport Expansion Projects, June 2004.

Airport have been built with private capital. The Incheon Airport Expressway Project has also been financed by the private sector. The costs for Phase 1 and Phase 2 construction of the airport were partially borne by Incheon International Airport Corporation. Due to state financial shortages, the corporation's financial burden related to the operation and management of airports is also increasing.

The airport development procedures are as follows: establishment and publication of the project plan (Ministry of Land, Infrastructure and Transport) → establishment, revision and publication of the execution plan (regional aviation administration) → compensation for land and obstructions (regional aviation administration) → bidding, contracting, construction, supervision and completion inspection (regional aviation administration) → opening of the airport following issuance of a public notice on its use (regional aviation administration).

Airport Operation

Korea currently has 15 airports serving civil aviation. Eight of them are civilian/military airports. Originally built as military air bases, they have been equipped with civil aviation facilities under an agreement between the Ministry of National Defense and the MOLIT. Civilian/military airports are in Gimhae, Gwangju, Cheongju, Daegu, Pohang, Gunsan, Sacheon and Wonju. These airports belong to the Air Force, except for Pohang and Gunsan airports, which are under jurisdiction of the Navy and the U.S. Air Force, respectively.

Airports are operated by Incheon International Airport Corporation and Korea Airports Corporation. Incheon International Airport Corporation is in charge of the management and operation of Incheon International Airport, which opened in 2001. The corporation implements its activities, pursuant to the Incheon International Airport Corporation Act that was enacted on February 1, 1999. The Korea Airports Corporation is responsible for the management and operation of the civilian airports in Gimpo, Jeju, Yangyang, Muan, Ulsan and Yeosu, as well as the civil aviation facilities

at military/civilian airports. Originally, the airports were managed by the regional aviation administrations in Seoul and Busan. The administrations were responsible for expansion, repair and maintenance, management of aircraft moving areas, parking lot management, flight safety control, airport security control, and management of state properties. Eventually, Korea Airports Corporation took over the right to manage and operate the airports overseeing repair/maintenance of airport facilities, expansion of facilities based on approval of the Ministry of Land, Infrastructure and Transport minister, management/operation of navigation facilities, management/operation of aviation lighting facilities, management/operation of marker beacons, passenger services, and noise compensation.

Table 3.4 Airport operators

Airport operators		International airports	Domestic airports	Total
Incheon International Airport Corporation		Incheon International Airport	-	1
Korea Airports Corporation	Civil airports	Gimpo, Jeju, Yangyang, Muan	Ulsan, Yeosu	6
	Military/civilian airports	Gimhae, Daegu, Cheongju	Gwangju, Sacheon, Pohang, Gunsan, Wonju	8

Source: Korea Civil Aviation Development Association, Aviation Yearbook, 2010.

Table 3.5 Founding purposes and main projects of Korea Airports Corporation and Incheon International Airport Corporation

Categories	Founding purpose	Major projects
Korea Airports Corporation	• Effective construction, management and operation of airports • Contribution to national economic growth and public welfare enhancement	• Management and operation of airports • Development of surrounding areas • Management and operation of aircraft, passenger and cargo facilities as well as airports
Incheon International Airport Corporation	• Effective construction, management and operation of Incheon Airport	• Research and surveys related to construction, management and operation of Incheon Airport • Construction, management and operation of airports, and development of surrounding areas • Projects entrusted by the state or regional autonomous governments in relation to construction, management and operation of Incheon Airport

Source: Websites of Korea Airports Corporation and Incheon International Airport Corporation.

Aviation Act

Korea enacted the Aviation Act in 1961. Previous to enactment, the nation relied on the Japanese Aviation Act, proclaimed in 1927 following its enactment in 1921, for handling legal affairs related to aviation. In 1958, the Ministry of Transport (presently, the Ministry of Land, Infrastructure and Transport) prepared a draft bill to enact the Aviation Act based on advice provided by experts invited from the U.S. Federal Aviation Administration. In November 1960, the finalized bill was submitted to the National Assembly after being approved by the Cabinet. The bill passed through the lower house of the Assembly on January 11, 1961 and the upper house on February 22 of the same year. It was proclaimed as Act No. 591 on March 7, 1961 and went into effect on June 8 the same year.[1] Since its enactment, the Act had been amended 61 times (partially amended 35 times, wholly amended once, and amended by other acts 25 times) by July 27, 2012.

Table 3.6 Timeline of the Aviation Act

Year	Law	Remarks
1927	Old Aviation Act (Japanese Aviation Act)	Japanese Aviation Act
1961	Enactment of the Aviation Act	Proclaimed as Act No. 591
July 2012	Amendment of the Aviation Act	Amended 61 times (partially amended 35 times, wholly amended once, amended by other acts 25 times)

Source: National Legal Information Center, www.law.go.kr, 2012 Aviation Act Amendment.

The Aviation Act is a basic law that stipulates regulations and standards on various matters related to aviation. It is comprised of 10 chapters on aircraft, aircrew, operation of aircraft, aviation facilities, air transport business, foreign aircraft, and other related topics. It has the characteristics of an international law in that it has to reflect changes in aviation-related international standards. In recent years, it has been amended nearly every

1) Korea Airports Corporation, History of Civil Aviation in Korea, Reorganized.

year to keep up with changes in international aviation environments.

The government organizations chiefly related to the aviation-related laws in the nation are the Ministry of Land, Infrastructure and Transport and the Ministry of Trade, Industry and Energy. Ministry of Land, Infrastructure and Transport administers and enforces eight laws and their subordinate decrees related to the aviation industry and safety. The Ministry of Trade, Industry and Energy bears responsibility for implementing and enforcing one law and its subordinate decrees related to the promotion and growth of the aviation industry.[2] In 2008, the Ministry of Defense abolished the law governing military aircraft and air bases, replacing it with the Military Base and Facility Protection Act. The Act provides for matters necessary for the protection of military bases and facilities as well as the facilitation of military operations.[3]

Table 3.7 Status of aviation laws

Ministries		Acts
Ministry of Land, Infrastructure and Transport (8)	Aviation Policy Bureau	Aviation Act, Aviation Safety and Security Act, Air Transport Business Promotion Act, Korea Airports Corporation Act, Incheon International Airport Corporation Act
	Airport Navigation Policy Bureau	Act on the Promotion of a New Airport for Seoul Metropolitan Area Construction, Airport Noise Presentation and Areas Assistance Act
	Secretariat of the Aviation and Railway Accident Investigation Board	Aviation and Railway Accident Investigation Act
Ministry of Knowledge Economy		Aerospace Industry Development Promotion Act
Ministry of Defense		Protection of Military Bases and Installations Act

Source: Ministry of Land, Transport and Maritime Affairs, Aviation Policy Theory, 2011.

On December 30, 2003, the Ministry of Land, Infrastructure and Transport amended the Aviation Act (Act No. 7024), classifying airport development plans into the Comprehensive Plan for Mid to Long-Term Airport Development and the Basic Plan for Airport Development designed for individual airports.

At the top of aviation-sector government plans, the comprehensive plan

2) Ministry of Land, Transport and Maritime Affairs, *Aviation Policy Theory*, 2011, p.599.
3) Ministry of Legislation, Military Facility Protection Act, www.moleg.go.kr.

is aimed at ensuring effective and systematic implementation of airport development projects. A statutory plan that should be renewed every five years to keep up with relevant social and economic changes, it covers all airports under operation or construction in the nation.

Metropolitan New Airport Construction Promotion Act

On May 31, 1991, the government enacted the Metropolitan New Airport Construction Promotion Act that provided for matters necessary for the construction of a new airport in the Seoul metropolitan area. It was designed to ensure effective implementation of the project, thereby coping with the rapidly rising air traffic demand and ultimately contribute to the growth of the national economy.[4] Incheon Airport was constructed pursuant to the law, which still serves as the basis for follow-up expansion projects underway at the airport. Development projects for other airports are government by the Aviation Act.

Airport Development Financing

Airport development projects are primarily financed by the state or airport corporations. The central government invests in nearly all of the projects.

Of the central government ministries, the Ministry of Land, Infrastructure and Transport is responsible for the implementation of airport development projects. State budgets are allocated to these projects by the Ministry of Strategy and Finance. Before determining whether to finance projects promoted by government ministries or regional autonomous governments, the Ministry of Strategy and Finance conducts preliminary feasibility studies. Feasibility studies are conducted pursuant to the State Finance Act, in order to prevent state financial resources from being squandered recklessly. The finances of a state consist of tax revenues and funds. The main source of finance for airport development projects is the Special Account for Transport

4) Ministry of Land, Transport and Maritime Affairs, *Aviation Policy Theory*, 2011, p.631.

Facilities. The Ministry of Strategy and Finance prepares funds from this account and allocates them to various development projects in the road, railway, port and airport sectors.

The percentages of financial burdens borne by the state and airport corporations are shown in Table 3.8. The state makes these investments by securing funds from the special account for transport facilities. As for Incheon International Airport Corporation and Korea Airports Corporation, their financial resources are their facility usage fee revenues and loans from financial institutions. Since 2009, the two corporations have borne most project costs.

Table 3.8 Airport development financing status (Unit: 1 million won)

Categories		2006	2007	2008	2009	2010	2011	Total
Incheon International Airport	State	307,100 (34.5%)	200,000 (28.3%)	65,500 (24.0%)	-	-	-	572,600 (28.1%)
	Incheon International Airport Corporation	583,112 (65.5%)	505,980 (71.7%)	207,940 (76.0%)	55,691 (100%)	43,833 (100%)	69,500 (100%)	1,466,056 (71.9%)
Other airports	State	58,259 (90.1%)	96,288 (85.0%)	42,218 (31.5%)	1,447 (1.4%)	5,000 (6.2%)	4,371 (12.5%)	207,583 (39.0%)
	Korea Airports Corporation	6,413 (9.9%)	17,029 (15.0%)	91,858 (68.5%)	102,965 (98.6%)	75,551 (93.8%)	30,716 (87.5%)	324,532 (61.0%)
Total	State	365,359 (38.3%)	296,288 (36.2%)	107,718 (26.4%)	1,447 (0.9%)	5,000 (4.0%)	4,371 (4.2%)	780,183 (30.3%)
	Airport corporations	589,525 (61.7%)	523,009 (63.8%)	299,798 (73.6%)	158,656 (99.1%)	119,384 (96.0%)	100,216 (95.8%)	1,790,588 (69.7%)
Total		954,884	819,297	407,516	161,103	124,384	104,587	2,570,771

Note: 2011 statistics are based on Ministry of Land, Transport and Maritime Affairs data.
Source: Ministry of Land, Transport and Maritime Affairs, Fourth Comprehensive Plan for Mid to Long-Term Airport Development (government notice), reorganized for 2006-2010 statistics, 2010.

Incheon Airport's second phase construction was completed in 2008. The airport facility investments have since gone down to below 200 billion won a year, with the percentages of financial burdens borne by the two airport corporations increasing. The state provided 40% of Incheon airport's first phase construction costs. The percentage was 35% for the second phase project. Since 2009, Incheon International Airport Corporation has been providing all the costs for the airport expansion project. As for the other airports, Korea Airports Corporation began participating in their facility

expansion projects financially in 2006.

The total investments to be made in airport development projects between 2011 and 2015 are estimated to reach 2 trillion won. About 90% of them are slated to be used for Phase 3 of Incheon International Airport.

The total costs for first phase construction of Incheon International Airport amounted to 6,771.2 billion won. The construction costs minus management expenses reached 5,632.3 billion won. When private-sector investments are not counted, 40% of the funds for the project were provided by the state. The remaining 60% were prepared by Incheon International Airport Corporation through the partial sale of land on the island, obtaining bank loans, issuance of bonds, and the introduction of foreign capital. Private capital was used to build the cargo terminal, aircraft fueling facilities, cogeneration plant, aircraft maintenance facilities, GSE maintenance facilities, in-flight meal supply facilities, warehouses, the airport expressway, and the railway. With exception for the railway, construction of all facilities was completed by December 2000. In particular, 11 domestic construction enterprises jointly launched a company named New Airport Highway for the construction of the airport expressway. Except for state investments made in its initial stage, the expressway was built entirely with private capital.[5] The public sector has a 34% stake in the fueling facilities and the cogeneration plant.

Building infrastructure facilities like airports requires large-scale investments. It is difficult for the government or a single corporation to bear the financial burden alone. The central government faces budgetary restrictions and regional autonomous governments have weaker financial capabilities. The airport corporations, which operate the airports, also lack sufficient financial resources.

To address these difficulties, the government (Ministry of Strategy and Finance) enacted the Promotion of Private Capital into Social Overhead

5) Incheon Airport Corporation, *History of First Phase Construction of Incheon International Airport 1991-2001*, 2001, p. 139.

Capital Investment Act in 1994. It was later replaced with the Act on Public-Private Partnerships in Infrastructure.

Private sector investments in infrastructure are made under one of the following schemes: build-transfer-operate (BTO), build-transfer-lease (BTL), and build-operate-transfer (BOT). Incheon International Airport Expressway was the first case implemented with private capital under the BOT scheme.

Section 3

Successful Operation of Incheon International Airport

Construction of Incheon International Airport

Background to Incheon Airport Construction

Air travel demand in the Seoul metropolitan area increased rapidly every year in the 1980s. In 1989, the number of international and domestic passengers at the airport reached 7.22 million and 6.72 million, respectively. These numbers represented average annual growth of 22.7% for international services and 12.6% for domestic routes between 1980 and 1989. Located in an urban commercial district, the airport faced increasing complaints raised by nearby residents about aircraft noise. The complaints led to a ban on nighttime flights, causing restrictions on airport operation. It also encountered restrictions in expanding its capacity as it could not build new runways due to the proximity of residential complexes.

In order to address these problems, the government began studying the prospect of constructing a new airport. It sought to build the new airport along the coast or on the sea in order to ensure 24-hour operation and prevent noise-related problems. In January 1989, the government decided to

build a new airport in the Seoul metropolitan area, conducting four feasibility studies and preliminary research, and selected preliminary candidate sites between June 1989 and April 1990. Candidate sites were selected within a 100 km radius from Seoul. The selection was based on 10 criteria such as air space, obstructions, restrictions, climate conditions, topography, and construction costs. Preliminary surveys were conducted for 22 areas in Gyeonggi Province and South Chungcheong Province. Of them, seven areas were picked as final candidate sites. They were Yeongjong, Sihwa 1, Sihwa 2, Songdo, Songsan, Icheon, and Baran.

Phase 1 Construction

A week after Yeongjong was selected, the Ministry of Transport set up a special task force to deal exclusively with affairs related to the construction of Incheon International Airport. In 1992, the New Airport Construction Headquarters was established at Korea Airport Corporation. It was formally inaugurated as Seoul Metropolitan Area New Airport Construction Corporation on September 1, 1994.

After completion of the basic design process between November 1990 and December 24, 1991, construction work began in earnest in November 1992 for the establishment of a "future Northeast Asian air transport hub." The nation saw the opening of the airport in March 2011 after 100 months of construction and an investment of 5.6 trillion won ($5.07 billion).

With construction lasting eight years and four months, it was the nation's largest ever state infrastructure project. As such, it required the mobilization of workers, devices and materials at an astronomically large scale. On average, 14,000 workers participated in the project daily, reaching an accumulated 13.8 million workdays. An aggregate total of 2.53 million pieces of equipment were mobilized for construction. Gravel and stones used for the project amounted to 9,747,000 m^3 in volume, the transportation of which required the mobilization of 1 million 15-ton trucks in aggregate. In addition, 180 million cubic meters of soil and sand were poured into the site to create

solid ground requiring 18 million 15-ton truck trips. The massive airport site, which covers 17 million pyeong (56,168,000 m^2) of land, was secured through huge financial and material resources.

Table 3.9 Incheon International Airport construction timeline

Year	Contents
June 14, 1990	Construction site finalized (Yeongjong, Sinbul, Sammok and Yongyu islands, Jung District, Incheon City)
June 21, 1990	New International Airport Construction Planning Group established
December 14, 1991	Korea Airport Corporation Law legislated and announced, Korea Airport Corporation designated as the executor of the new airport construction project
January 31, 1992	New Airport Construction HQ established in Korea Airport Corporation
September 1, 1994	Metropolitan Area New Airport Construction Corporation established
November 28, 1995	Basic Plan revised (2nd)
February 1, 1999	Incheon International Airport Corporation established
March 29, 2001	Opening
December 31, 2001	Phase 2 Basic Plan announced
September 28, 2005	Basic Plan revised (5th)
June 2008	Phase 2 construction completed and operation initiated
June 30, 2009	Phase 3 Basic Plan announced
June 8, 2010	Phase 3 airport facility base design initiated

Source: Ministry of Land, Transport and Maritime Affairs, Fourth Comprehensive Plan for Mid to Long-Term Airport Development, 2010.

The airport covers an area of 11,724,000 m^2. The most prominent structure sitting in this area is the main passenger terminal. With a floor space of 496,000 m^2, it is bigger than any other building in Korea. Other structures built during Phase 1 include the cargo terminal with annual capacity of 2.7 million tons (excluding baggage), and two 3,750 meter-long runways that have sufficient capacity to accommodate the world's largest aircraft.

Incheon Airport was built on a piece of land artificially created between several islands in Gyeonggi Bay. The site consists of a 46,281,000 m^2 reclaimed area created between the islands, which were originally separated by shallow water 1 meter deep at high tides, and the natural ground on the islands covered 56,199,000 m^2. The total area was 18 times as spacious as Yeouido Island in Seoul which contains both the financial district and multiple broadcast studios. The site was blocked from the sea with 17.3 km

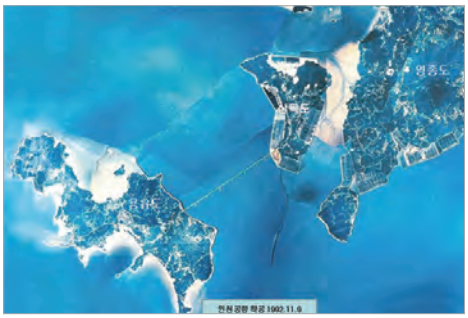
of seawalls (south 6.08 km, north 7.3 km, east 3.9 km). For site formation, various ground improvement techniques were employed, such as sand drain, preloading and plastic board drain methods. The site formation work began in November 1992. Eventually, the work was conducted after dividing the site into 11 sections, including three where the south and north seawall projects and the eastern ring road construction work was underway. The site formation process for Phase 1 construction was completed at the end of 2000.

By the time the final stage of construction is completed, Incheon Airport will have five runways. All runways are planned to be aligned in a north-south direction with three to the east of the passenger terminal and the remaining two to the west.[6] Two runways were built for the first phase. The distance between the two runways is 414 meters, allowing simultaneous landing and taking off of aircraft during instrument flight. With this allotment, one aircraft can take off and another can land at the same moment. Once construction is completed up to runway 4, Incheon International Airport will have the capacity to handle 1,500 flights per day on average. This means it will be able to accommodate about 530,000 flights a year. With an area of 1,203,000 m^2, the apron has 44 boarding gates and 16 remote ramps.

The passenger terminal was built through a combination of Korea's best construction technology and its advanced information communications system. Its construction served as an occasion to upgrade the nation's construction technology. The floors of the building are categorized according to functions and moving lines: the ground floor for international arrivals, the second floor for domestic departures and arrivals, and the third floor for international departures. The underground level houses the train tunnel connecting the terminal to the concourse and luggage transport facilities.

6) Under the plan, there will be five runways, which will eventually operate as three independent runway systems.

Figure 3.3 Incheon International Airport phase 1 construction process



Start of construction on November 9, 1992,

Completion of seawalls on October 1994

Start of runway and passenger terminal construction in 1996

Completion of basic airport facilities in October 2000

Opening of Incheon Airport on March 29, 2001

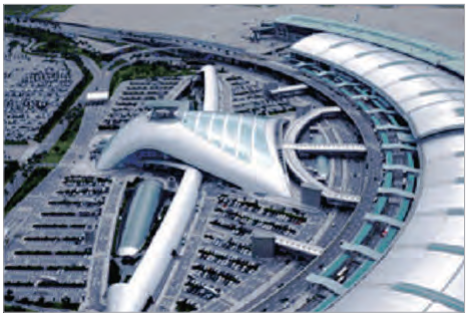
Source: Incheon International Airport Corporation, Airport Planning Group.

Table 3.10 Incheon International Airport facilities and capacity at phase 1

Categories		Phase 1
Facility	Site scale	11,724,000 m^2
	Runway	2 (3,750 m × 60 m each)
	Passenger terminal/gate	496,000 m^2 / 44 gates
	International business complex	165,000 m^2
Capacity	Passenger	30 million passengers a year
	Cargo	2.7 million tons a year (including luggage)

Figure 3.4 Key facilities of Incheon International Airport at phase 1

Passenger Terminal



Transport Center

Cargo Terminal

Runway, Taxiway

Source: Incheon International Airport Corporation website.

Phase 2 Construction

Phase 2 construction began in 2002, aiming to cope with a sharp rise in air demand following the airport's opening in 2001 and to flexibly respond

to intensifying competition from its rival airports. Phase 2 was carried out through June 2008, with investment of 3 trillion won and the mobilization of a substantial number of workers. Key facilities built during Phase 2 included a 4,000 meter-long third runway, which can accommodate the landing and take-off of super large aircraft like Airbus 380, and a concourse with 30 passenger boarding bridges. The project also expanded the cargo terminal and installed 60 more passenger and cargo plane ramps.

Based on airport construction know-how accumulated through Phase 1 construction, the airport systematically managed numerous interfaces that occurred as a result of simultaneous implementation of countless work processes, thereby successfully completing the project without any delay in the work process or degradation of construction quality. With completion of Phase 2, Incheon International Airport secured the physical size suitable for status as a large hub airport. Its annual capacity drastically rose from 30 million to 44 million passengers, 2.7 million tons of cargo to 4.5 million tons, and 24,000 flights to 41,000. Now the airport secured sufficient facilities and operational efficiency to cope with future increase in air demand. This in

Figure 3.5 Aerial view of Incheon International Airport at phase 2

Source: Incheon International Airport Corporation, Airport Planning Group.

turn gave the airport better opportunities to expand routes as well as transit and trans-shipment networks. Moreover, Incheon Airport was turned into an IT-based ubiquitous airport also known for artistic and cultural activities as well as world-best commercial facilities. This transformation occurred as the airport continuously pursued the idea of developing itself not just as an aviation hub but as a multi-complex that provides various services and implements various functions related to culture, rest, entertainment and shopping. Having created a new space as an airport that is "more than an airport" and presenting a new paradigm for airport operation, Incheon International Airport is now the envy of airports around the world.

Table 3.11 Incheon International Airport facilities and capacity at phase 2

Categories		Phase 2
Facility	Site scale	9,568,000 m^2
	Runways	1×(4,000 m×60m)
	Apron	1,170,000 m^2
	Concourse	166,000 m^2
	Cargo terminal	1,267,000 m^2
Capacity	Passenger	40 million passengers
	Cargo	4.5 mil. tons (including luggage)

Phase 3 Construction Project

The Ministry of Land, Infrastructure and Transport is implementing the third phase expansion project in order to firmly establish Incheon International Airport as the hub airport of Northeast Asia. The ministry gave public notice of the basic plan for the third expansion project on June 30, 2009.

The project includes work to build a new passenger terminal to the north opposite the present one as well as expand the existing cargo terminal and aprons. Access facilities (roads, railway) are also planned to be built to connect the first and second passenger terminals. In addition, the second phase construction of the airport logistics complex is slated for development of a global logistics hub with high added-value products. The project will

involve various programs to develop Incheon Airport into an environmentally friendly green airport in accordance with the government's low-carbon green growth policy. Specifically, the second passenger terminal is slated to be built as an energy-efficient structure through the use of solar energy and other types of renewable energy. Other green programs include the construction of bike paths and a magnetic levitation railway system starting within the airport complex. The project is estimated at 4 trillion won, which will be funded by the state and Incheon International Airport Corporation. Phase 3 construction, which started in 2011, is scheduled to be completed in 2017.

Once Phase 3 is completed, annual capacity will increase from 44 million passengers to 62 million, and 4.5 million tons of cargo to 5.8 tons. Expected effects include the creation of about 80,000 jobs during the construction period. The project is also expected to generate a production inducement effect worth 7.8 trillion won and create added value of 3.3 trillion won.

Additionally, a related project is underway to install various transport facilities designed to ensure improved airport access. Some facilities already

Figure 3.6 Artist's conception of Incheon Airport's 2nd passenger terminal

Source: Ministry of Land, Infrastructure and Transport, Groundbreaking Ceremony for Incheon International Airport's 2nd Passenger Terminal, press release, September 26, 2013.

established include Incheon International Airport Expressway that opened November 2000, the first phase section of the airport railway that opened March 2007 (Incheon Airport ↔ Gimpo Airport), Incheon Bridge, the world's 5th longest cable-stayed bridge that opened October 2009, and the second phase section of the airport railway (Gimpo Airport ↔ Seoul Station) that opened November 2010. Incheon International Airport has also installed a second inner city air terminal at Seoul Station. In 2014, a new rail connection was finally opened allowing people to travel from their local province to Incheon International Airport by KTX. These activities represent the airport's incessant efforts to increase passenger convenience.

The airport aims to eventually expand its site to 47 million square meters and increase its annual passenger and cargo capacities to 100 million and 10 million tons, respectively. However, decisions on when to implement the final-stage expansion project will be made flexibly by considering future demand for aviation services at the airport.

Table 3.12 Construction scale of each phase

Categories	Phase 1	Phase 2	Phase 3 (plan)	Total
Site scale	11,724,000 m^2	9,588,000 m^2	1,410,000 m^2	47,428,000 m^2
Runway	2 (3,750 m×60 m)	1 (4,000 m×60 m)	-	4-5
Passenger apron	1,267,000 m^2	1,170,000 m^2	690,000 m^2	
Passenger terminal	496,000 m^2	-	350,000 m^2 (2^{nd})	
Concourse	-	166,000 m^2	-	
Project cost	5.632 trillion won	3.918 trillion won	4.336 trillion won	
Expressway	40.2 km (6-8 lanes)	-	-	-
Railway	-	58.0 km (double track)	-	-

Source: Ministry of Land, Transport and Maritime Affairs, Fourth Comprehensive Plan for Mid to Long-Term Airport Development, 2010.

Table 3.13 Airport capacity by phase

Categories	Phase 1	Phase 2 (Phase 2 / total)	Phase 3 (Phase 3 / total)	Final goal
Annual passengers (million persons)	30	14/44	18/62	100 million passengers per year
Annual cargo (million tons)	2.7	1.8/4.5	1.3/5.8	10 million tons per year

Source: Ministry of Land, Transport and Maritime Affairs, Fourth Comprehensive Plan for Mid to Long-Term Airport Development, 2010.

2. Success Factors of Incheon International Airport

Government's Commitment and Dedication

Constructing huge infrastructure facilities like Incheon International Airport requires the central government's commitment and dedication. It is essential to build consensus beforehand among the relevant ministries on the necessity of such facilities. The nation's President should exert resolute leadership to ensure the success of such projects. It is also important to gain parliamentary consent.

The idea of Incheon Airport was conceived from a macroscopic perspective, based on an understanding that it would be a major driver of economic growth. It was quite a courageous and forward-looking idea, given the size of the national economy at the time. The aspiration to build the airport into a Northeast Asian logistics hub was consistently maintained for 20 years which directly contributed to its successful construction. After its opening, the airport achieved stellar performance, which helped the government and airport authorities garner further support from the people. Based on public support, the airport is making further progress. Ensuring smooth operation of an airport requires close cooperation of the Ministry of Justice, Customs, and quarantine organizations. In this regard, the government merits praise for exerting leadership to ensure cooperative ties between the relevant organizations while pursuing common goals for developing Incheon Airport into a hub in Northeast Asia.

Efficient Airport Operation System

Incheon International Airport has outsourced contracts with 37 companies in the categories of airport operation, facility maintenance and repair, and information and communications. As of January 2010, the number of employees working for these cooperating companies reached 6,000. Specifically, the airport uses outsourcing in the following areas: terminal

operation, traffic control, cleaning, security and inspection, terminal and subsidiary building repair and maintenance, airport construction data management, information communications system repair and maintenance, fire prevention, and the expulsion of birds and other wild animals.

Incheon International Airport has outsourced in an impressive manner in terms of scale, diversity, and performance. Its capacity to ensure successful outsourced operations is also considered the best in the nation. Its successful in this area is cited as one of the most important factors that allow Incheon International Airport to maintain its status as the world's top-ranked airport. In the initial stage, outsourcing was more of a subcontracting concept based on a hierarchical relationship. As such it was difficult to expect the subcontractors to provide more than perfunctory services. Continuous efforts were made to improve the outsourcing system, but change did not occur immediately. When selecting companies, emphasis was given more to cost savings and workforce management than the prospect of ensuring quality. Additionally, outsourcing contracts were based on the input of workers or the amount of work to be handled. Under such a scheme, it was difficult to satisfy detailed requirements related to service quality. These problems prompted Incheon International Airport Corporation to formulate measures for an overhaul of the outsourcing system. The corporation introduced the service level agreement system in outsourcing in January 2007 after implementing it on a pilot basis for six months from July through December in 2006. Service level agreement is based on the concept of quantifying minimum service quality acceptable by users. Under the new system, the criteria for signing outsourcing contracts was switched from the number of employees or amount of work to quality of services. It may be referred to as a kind of smartsourcing,[7] a more developed form of outsourcing. By employing this new scheme, Incheon International Airport has been able to achieve

7) Smartsourching: A compound of smart and outsourcing, smartsourcing means a new form of outsourcing. It focuses on seeking partners for forging cooperative relations based on quality, departing from the traditional outsourcing method oriented toward financial savings.

mutual growth of both users and collaborating companies.

Speedy Airport Services

International air passengers usually have to arrive at the airport two to three hours ahead of their actual departure time. They are asked to do so by travel agents and carriers as unexpected difficulties may arise during boarding processing. So, it is absolutely necessary to arrive at the airport with plenty of extra time.

Departures and arrivals take only 18 minutes and 14 minutes, respectively, significantly lower than the standard 60 minutes and 45 minutes recommended by the International Civil Aviation Organization. Incheon International Airport boasts the world's fastest entry and exit procedures, thus earning its reputation as the world's best airport. A review of annual duration for entry and exit shows that exit time was reduced by about 11 minutes from 29 minutes 23 seconds in 2005 to 18 minutes 48 seconds in 2009. Entry time was shortened by six minutes from 20 minutes 30 seconds to 14 minutes 29 seconds. The amount of time required to complete exit and entry procedures can serve as an index that represents the degree of an airport's advancement. This is because it is an area where the passengers most directly experience an airport's service quality. This applies to not only Incheon Airport but any other airport in the world. No doubt, speedy processing is one of the most important elements that determine the competitiveness of an airport.

Incheon International Airport's success is based on its faithful adherence to the most basic and fundamental functions required of an airport. Airport service means helping passengers complete entry and exit procedures in the speediest fashion. By faithfully implementing the basic functions required of an airport, Incheon International Airport could expedite the entry and exit processes. This naturally led to increased airport profit as passengers who quickly completed entry and exit procedures spent more time at the commercial facilities. Consequently, Incheon International Airport has

been ranked first among the world's airports in terms of speedy entry/exit procedures as well as per-capita duty free sales amount. Put another way, it has become an airport characterized by stellar performance in both airport services and profits. The airport has concentrated on improving services related to even the most insignificant matters. This attitude has played a crucial role in improving the airport's overall service level.

Differentiated Marketing

In 2007, Incheon International Airport launched its own Culture and Arts Advisory Committee comprised of experts from various culture and arts sectors related to cultural criticism, performance, art, sculpture, architecture, and exhibition. It then began to conduct research on unique cultural and artistic contents that can be exclusively experienced at the airport. The airport's culture and arts activities are implemented in the categories of experience, performance, and exhibition. Experience-related services are designed to help foreign visitors better understand Korea's traditional culture. To this end, the airport collaborates with Korea Cultural Heritage Foundation, offering crafts classes for paper fans, traditional Korean paper and knots, and musical performances showcasing the danso. The performance service is to entertain travelers while they spend time at the airport. Exhibitions play key roles in publicizing the excellence of Korean art. Particular emphasis is placed on the royal palace culture, the Hangeul alphabet, and traditional art. Exhibitions are held mostly at the Korean Culture Museum that focuses on publicizing Korea's history, the traditional craft exhibition hall "Korea House" where viewers can see ceramics and traditional attire, and entry port culture streets where incoming visitors can enjoy viewing art by the world-renowned artist PAIK Nam June, a diversity of photo exhibits, wooden furniture, and traditional earthenware. Instead of simply entertaining international travelers, the airport is seeking to create new values by helping these visitors more deeply understand Korea. In 2009, Incheon International Airport won the 10th Mecenat Creative Award for its

cultural and artistic activities. Efforts were recognition by Korean society as a crucial role the airport plays as gateway to the world, particularly in effectively publicizing Korean culture to international visitors to Korea. The 21st century is the age of culture and emotion. Products sell strong when packaged in cultural and emotional outfits. The airport helps overseas visitors feel and experience cultural and artistic aspects of Korea while providing local residents with opportunities to enjoy cultural products. The airport conducts these activities not just for marketing purposes but for contributing to society in a manner that ensures a coexistence of enterprises and culture. Pursuing cultural differentiation will become the most effective means of marketing.

Section 4

Changes in Regional Airports

Korea's air transport industry was badly hit by the 1997 financial crisis. At that time, air traffic demand went down significantly for both international and domestic routes. Demand for international services rebounded in following years, but business for domestic lines has never regained its vitality. In particular, demand for air travel between Seoul and the provinces rapidly decreased following the opening of new expressways beginning in the late 1990s as well as the first phase section of the high-speed railway in 2004. Business has flourished on air flights to Jeju as the exception, as air travel does not compete with ground transportation over that route. The government did not pay due attention to such changes in the domestic aviation market. The nation continued implementing domestic airport expansion projects which had been underway since the 1990s resulting in an excessive supply of airport facilities. The impacts of the expansion of road and rail networks on the air transport industry have turned out to be greater than expected.

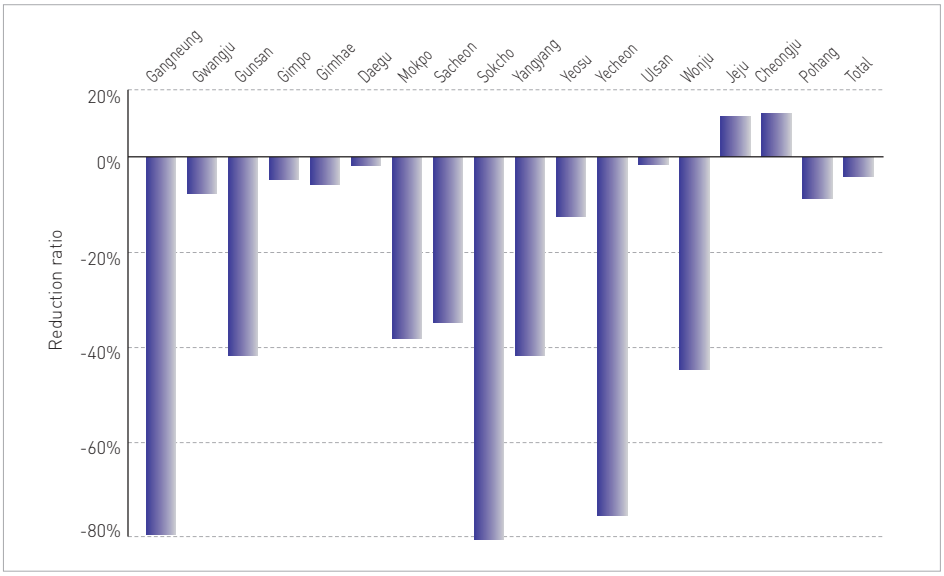
1. Changes in Air Traffic Demand Following Expressway Expansion

Following the opening of two new expressways, Seohaean and Jungbu, and the expansion of Yeongdong Expressway at the end of 2001 under the government's nationwide transport network plan, demand for domestic air services began to drop sharply.

At Gunsan and Mokpo airports the number of passengers decreased 41% and 37%, respectively, following the opening of the Seohaean Expressway on the west coast. Sacheon Airport suffered a 34% decrease in passenger traffic as demand for its service was negatively affected by the opening of the Daejeon-Jinju Expressway. The passenger volume at Yecheon Airport decreased 75% after the opening of the Jungbu Expressway eventually leading to its closure.

Passenger traffic volumes at Wonju Airport and Yangyang International

Figure 3.7 Passenger traffic decrease rates at airports following the opening of expressways



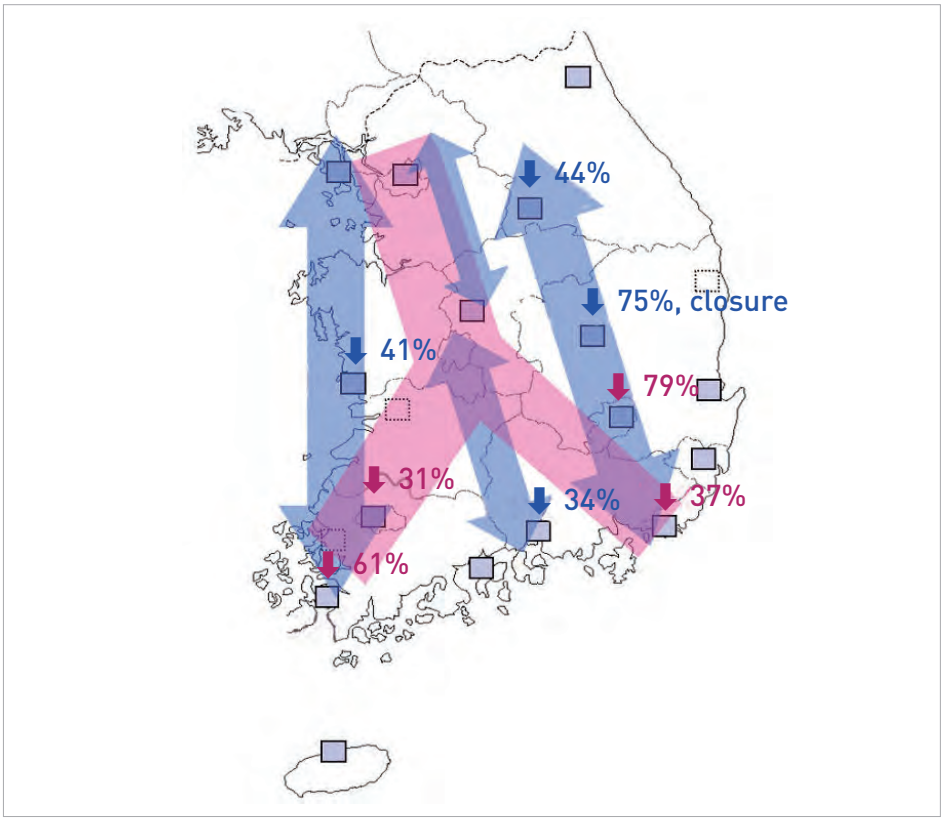
Note: Comparison between performance before the opening of expressways (December 2000-November 2001) and after their opening (December 2001-November 2002).
Source: Ministry of Land, Transport and Maritime Affairs, Survey for Third Comprehensive Plan for Mid to Long-Term Airport Development, 2005.

Airport contracted by 44% and 41%, respectively, apparently affected by the expansion of the Second Jungbu Expressway and the Yeongdong Expressway.

2. Changes in Air Traffic Demand Following Opening of High-Speed Rail

Opening the first phase of the Seoul-Busan high-speed railway brought about significant changes in the nation's overall ground transport system. This also

Figure 3.8 Changes in air traffic demand following the opening of the high-speed railway



Note: Percentages in red (79%, 37%, 31%, 61%) represent the negative impacts the opening of the high-speed railway had on passenger traffic on Gimpo, Gimhae, Gwangju and Mokpo routes. The others represent changes in air traffic demand affected by road transport.
Source: Ministry of Land, Transport and Maritime Affairs, Survey for Third Comprehensive Plan for Mid to Long-Term Airport Development, 2005.

had significant impacts on regional airports in cities along the Seoul-Busan corridor, including Daegu, Busan, Pohang, Ulsan, and Sacheon.

Following the opening of the high-speed railway, demand for air services shrank by 79% on routes to Daegu, 37% on Gimhae routes, and 28% on Gwangju routes.

Table 3.14 Changes in air traffic demand following the opening of the KTX high-speed railway

Classification		Gimpo - Daegu	Gimpo - Gimhae	Gimpo - Gwangju	Gimpo - Mokpo
Number of passengers (persons/ year)	Before opening (April 1, 2003~March 31, 2004)	1,401,319	5,176,949	1,177,082	69,538
	After opening (April 1, 2004~March 31, 2005)	298,017	3,274,995	847,511	26,916
Year-on-year negative growth rate		– 79%	– 37%	– 28%	– 61%

Note: Reductions in passenger numbers may have been caused by other factors as well as the opening of the high-speed railway.
Source: Ministry of Land, Transport and Maritime Affairs, Survey for Third Comprehensive Plan for Mid to Long-Term Airport Development, 2005.

Section 5

Implications and Airport Policy Directions

The Korean aviation market expanded rapidly with the nation's continued economic growth in the 1980s, reaching a peak in 1997. Airport terminal expansion could not keep up with growth in the number of passengers. To address the problem, the government established a plan for systematic and comprehensive development of airports. It also prepared a legal and institutional framework for implementing airport development projects according to the plan.

The Comprehensive Plan for Mid to Long-Term Airport Development is renewed every five years, pursuant to the Aviation Act. It is aimed at ensuring systematic implementation of airport development projects and building an effective airport system. Based on the plan, the government has been able to forcefully implement its airport policies and effectively use relevant budgets.

The operation of airports was entrusted to airport corporations. As of January 2013, the nation had 15 airports in service. Korea Airports Corporation is in charge of airport operation with exception of Incheon Airport. Of the 14 airports managed by Korea Airports Corporation, eight are civilian/military airports, the ownership of which belongs to the military. At these airports, the corporation manages and operates only facilities

installed for civil air services. In the nation's airport history, the construction of the world-class Incheon International Airport can surely be cited as the most distinguished achievement. However, the government has left much to be desired in regard to regional airports, which have yet to regain their vitality.

Incheon International Airport opened on March 29, 2001, eight years and four months after its construction started on November 12, 1992. The government implemented the project to build an airport that could replace Gimpo as the nation's primary airport. Incheon Airport was ranked first from 2005-2014 in the annual airport service quality evaluation conducted by Airport Council International. It is an achievement no other airport in the world has attained.

Regarding the success of Incheon Airport, the most crucial factor has been the government's strong determination. All relevant government ministries and organizations cooperated closely to ensure success of the airport. The government has also maintained a consistent policy in regard to the airport, thereby gaining trust and support from the public.

The government created a special account in order to secure funds for investment in projects to develop airports, roads, railways and ports. The government also prepared the pertinent legal and institutional framework. These can be cited as important success factors of Incheon Airport.

Unlike Incheon Airport, regional airports continue to suffer setbacks. The nation's economic growth led to an increase in demand for regional development projects. Politicians then got involved by pushing for development of airports in their regions. Consequently, airport development projects were implemented in various regions. Now, they are cited as examples of over-investment in infrastructure.

When promoting regional airport development projects, the government failed to fully consider the effects of the expanding road transport networks. Plans for developing regional airports should have been based on in-depth analysis of the effects of the government project to expand the nation's arterial road and railway networks. The government also wasted

opportunities to make relevant changes mid-way through the projects. Affected by ground transport, air traffic has dropped significantly on inland air routes. However, air traffic volumes on routes to Jeju have increased. Currently, the most important routes for regional airports are not the routes to Seoul but those to Jeju Island.

Airports serve as facilities designed to provide public services in relation to aviation. They are infrastructure facilities for regional and national development. For these reasons, the Korean government actively implemented airport development projects. Regrettably, it made excessive investments for regional airports.

In most countries, aviation has low mode shares compared with road or rail transport leading to airports given low priority of infrastructure investment. Governments always have tight budgets, so it is difficult to expect sufficient funds to be allocated for airport development projects. Despite such difficulties, politicians will put direct and indirect pressure on the government while calling for the implementation of airport development projects in their regions.

The central government needs to build a legal and institutional framework that will make it possible to implement airport development projects without being affected by changes in external environments. In addition, it should promote airport development from a comprehensive perspective that takes into account other transport development plans. The scale of investments must be determined based on the functions and roles of each airport. It is important to establish a comprehensive and systematic airport development plan and to secure a framework for its implementation in a way that can meet the guidelines presented in this paper.

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Chapter
04

Global Aviation Safety Policies

Section 1

Analysis of Global Aviation Safety Policy Trends

1. International Trends

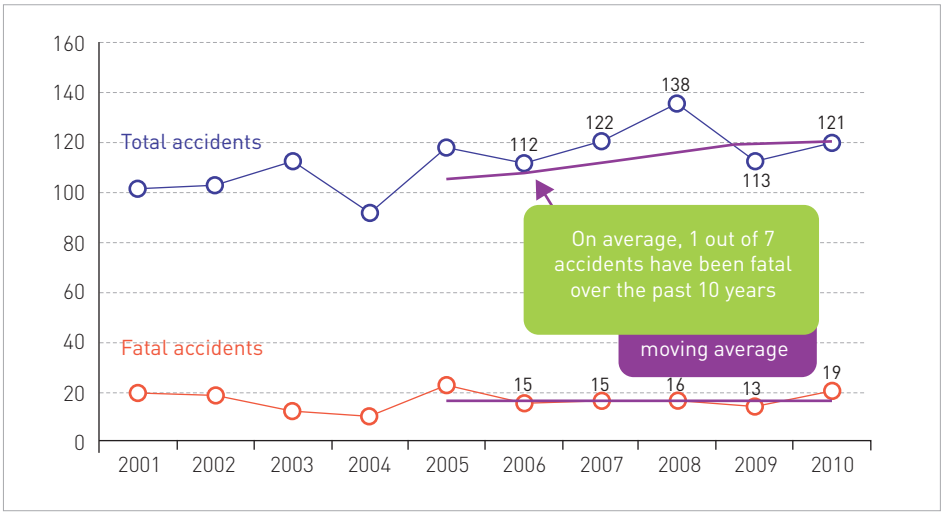
Overview

Korea needs to establish a national-level strategy to cope with new aviation safety policies being promoted globally to further enhance the safety of air passengers. Its aviation safety level is directly related to development of the nation's aviation industry, as was demonstrated in the FAA[1] classification of Korea as a Category 2 nation in safety rating. Given this, it is very important for the nation to actively respond to new policies being formulated in the international aviation sector.

With rapid increases in air traffic demand in China and India, global aviation traffic is forecasted to grow at a fast pace. The growth in traffic will likely cause an increase in aviation accidents. In the Asian region, the number of fatal accidents has been leveling off in recent years, although there have

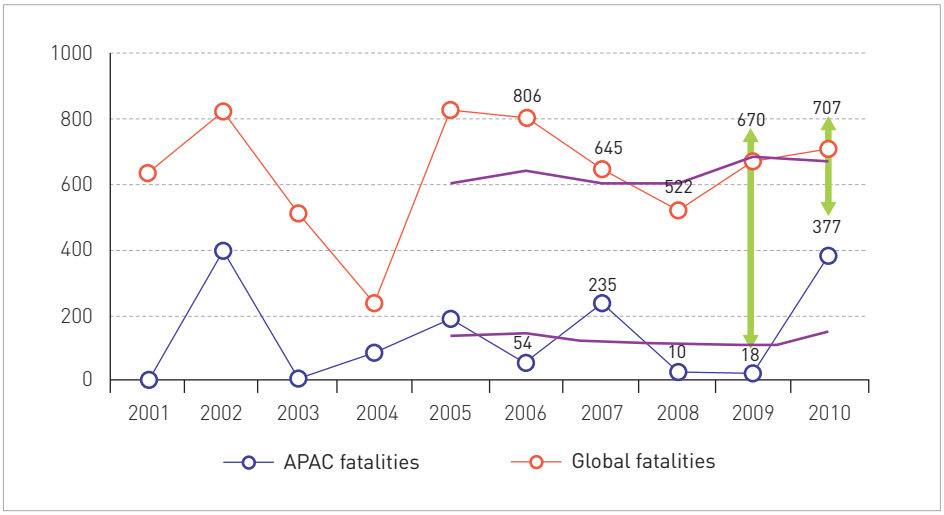
1) Federal Aviation Administration: agency of the U.S. Department of Transportation. It is headquartered in 800 Independence Avenue, SW, Washington, DC 20591.

Figure 4.1 Accidents and fatal accidents in the Asian region



Note: Scheduled commercial traffic exceeding maximum takeoff weight of 2,250 kg.

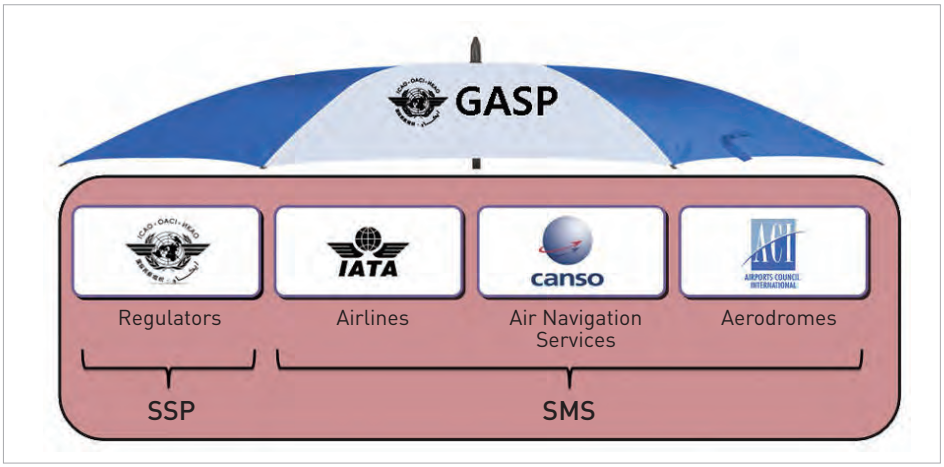
Figure 4.2 Fatalities in the Asia-Pacific region and globally from 2001 to 2010



Note: Scheduled commercial traffic: maximum takeoff weight 〉 2,250 kg

been ups and downs in the number of overall aviation accidents (Figure 4.1) while globally air fatalities have been increasing. In particular, there is the likelihood of a rapid rise in the deaths from plane crashes in the Asia-Pacific region (Figure 4.2). Statistics over the most recent 10 years show that one out

Figure 4.3 International organizations participating in the Global Aviation Safety Plan



Note: SSP: State Safety Programme, SMS: Safety Management System.

of seven crashes among scheduled commercial flights (exceeding 2,250 kg in maximum takeoff weight) involved fatalities.

During this period, the number of overall fatalities in the scheduled commercial traffic (exceeding 2,250 kg in maximum takeoff weight) went up just slightly. In contrast, it rose sharply in the Asia-Pacific region to the extent that it surpassed the largest number of airline crash deaths recorded during the period. Facing this problem, nations engaged in global air transport are cooperating with relevant international organizations (i.e.: ICAO, IATA[2]) and regional consultative bodies (including Regional Aviation Safety Group promoted by ICAO) to intensify efforts to improve the level of aviation safety. ICAO established and implemented a new Global Aviation Safety Plan (GASP) in 2013 by expanding the scope of the current GASP. GASP was adopted in 1997 as a global plan for the prevention of plane crashes. In 2007, a collaborative system was established involving the stakeholders to formulate a joint road map among ICAO, its contracting states, and related

2) International Air Transport Association: a trade association of airlines that sets international airfare rates. Most low-cost carriers do not have its membership. It provides certification to travel agencies worldwide, except those in the United States. It also publishes manuals on regulations on the classification of dangerous materials and transport restrictions on such materials.

organizations. The GASP was renewed in 2013 is extended in its range of application through cooperation with IATA and other related international organizations.

Analysis of Global Aviation Safety Policy Trends Based on ICAO Plans

This paper analyzes global aviation safety policy trends by focusing on relevant ICAO plans. GASP, which was renewed in 2013, is considered the highest-echelon plan. The 2013 GASP differs considerably from the previous plans, and serves as the guideline for national safety plans. So, it is essential to identify its contents and develop measures to ensure proactive response. ICAO requires regional aviation safety plans based on its global plan and that the contents of the regional plans should be incorporated into national-level safety plans. In its 37th Assembly, ICAO decided to include in GASP new safety enhancement policies designed to ensure the sharing and transparency of aviation safety information as well as State Safety Programme and safety management system (SMS) implementation.

Table 4.1 Main contents of the Global Aviation Safety Plan

Policies and standards	Safety monitoring and analysis	Implementation of safety enhancement policies
• Working with the aviation community (Global Aviation Safety Plan) • Working with Safety Management • Realizing synergies between GASP and Global Air Navigation Plan	• Continuous monitoring • Facilitating collection, sharing, and use of safety intelligence • Generating new sources of safety data	• Coordinated community responses • Addressing the main causes • Addressing regional differences

The new GASP pursues changes toward the "sharing of aviation safety information through a collaborative system among international organizations" as well as a shift from the comprehensive system approach based on one-time inspection of the implementation of international standards to the continuous monitoring approach (CMA) based on continuous analysis of both internal and external information. These new directions make it necessary to better understand the application of IT and the information sharing system in order to effectively respond to international

trends in aviation safety management. Against this backdrop, the core contents of aviation policies promoted globally are summarized below.

Reinforcement of International Aviation Safety Surveillance

Aviation is a crucial mode of international transportation. As such, it requires a uniform application of rules designed to ensure safety and reliability. ICAO enacted 10,091 articles of international standards (as of 2013) in the 18 annexes to the International Air Transport Agreement through the 1980s. However aviation accidents rose sharply in the early 1990s with remarkable expansion in global air traffic. This raised awareness of the seriousness of aviation safety problems. As factors that caused the increase in accident rate, each state's failure to implement pertinent international standards and the lack of an efficient surveillance scheme were cited. Then, the global aviation sector began to discuss the need for a safety system aimed at addressing such problems.

Consequently, ICAO decided to implement the Universal Safety Oversight Audit Program (USOAP) and publish its results. Additionally, it established the GASP and the Global Air Navigation Plan, and called for their implementation.

In 2013, ICAO successfully transformed USOAP to a continuous monitoring system based on the application of IT. The previous year, it established a new GASP by reflecting changes in the global aviation environment. These actions were basically aimed at intensifying international air safety surveillance through the sharing of bilateral and multilateral information.

For information sharing, ICAP provides USOAP, ADREP and ECCAIRS information to the United States and the EU. In return, it receives information on the FAA IASDEX and the EU blacklist of unsafe airlines. Further, it is promoting collaboration with aviation safety evaluation systems like the U.S. IASA and the EU SAFA. Reinforcement of international surveillance is expected to help facilitate the implementation of safety measures, including those aimed at inducing unsafe airlines to exist the market.

Table 4.2 ICAO, EU, FAA safety evaluation results

Countries		ICAO Safety Concern List	EU Blacklist	FAA Class 2 countries
1	Philippines	×	△	×
2	Bangladesh	×	×	○
3	Zambia	×	○	×
4	Angola	○	△	×
5	Rwanda	×	×	×
6	Kazakhstan	○	△	×
7	Congo	×	○	×
8	Djibouti	○	○	×
9	São Tomé and Príncipe	×	○	×
11	Malawi	○	×	×
12	Mozambique	×	○	×
13	Indonesia	×	△	○
15	Democratic Republic of Congo	×	○	×
17	Madagascar	×	△	×
18	Sudan	×	○	×
19	Liberia	×	○	×
20	Sierra Leone	○	○	×
21	Gabon	×	△	×
22	North Korea	×	△	×
23	Kyrgyzstan	×	○	×
24	Benin	×	○	×
25	Comoros	×	△	×
26	Barbados	×	×	○
28	Ghana	×	△	○
29	Guinea	×	×	○
33	Uruguay	○	×	○
34	Nicaragua	×	×	○

Notes: ○ : (EU Blacklist) Flight restrictions on all airlines of the country concerned.
△ : (EU Blacklist) Flight restrictions on some types of aircraft.
Airlines serving Korea: Indonesia 1 (Garuda), Kazakhstan 1 (Air Astana), Philippines 3 (Cebu Pacific, Philippine Airlines, Zest Air).
Data is accurate as of December 2014.
Source: Ministry of Land, Infrastructure and Transport, Safety Information of Airlines Which serve Flights to Korea, 2014.

Table 4.3 Results of the 2nd ICAO USOAP for countries with significant safety concerns

Countries that underwent audit		Audit Results by Element								
		Basic laws	Detailed regulations	Aviation structure	Certified training of technical manpower	Technical guidelines	License/ certification	Safety oversight	Resolution of safety-undermining elements	Average rate of implementation
1	Philippines	9	6	7	4	6	7	6	4	6
2	Bangladesh	3	5	2	1	4	5	4	2	3
3	Zambia	7	4	4	1	3	4	4	1	4
4	Angola	8	4	4	2	4	4	2	1	4
5	Rwanda	2	2	3	2	2	2	3	1	2
6	Kazakhstan	8	5	4	1	5	7	3	3	5
7	Congo	5	5	1	1	2	1	2	1	2
8	Djibouti	1	1	1	1	1	1	1	1	1
9	Sao Tome and Principe	7	4	2	1	2	1	2	1	3
10	Guinea-Bissau	7	3	2	1	1	1	1	1	2
11	Malawi	5	3	3	2	4	4	4	2	3
12	Mozambique	7	3	2	1	1	2	1	1	2
13	Indonesia	8	9	8	6	9	9	9	7	8
14	Swaziland	6	2	1	1	1	1	1	1	2
15	Democratic Republic of Congo	4	2	2	1	1	1	1	1	2
16	Ukraine	8	7	8	7	7	9	8	6	8
17	Madagascar	7	3	3	1	4	3	2	1	3
18	Sudan	9	7	5	1	6	5	4	4	5
19	Liberia	6	2	3	3	2	2	2	2	3
20	Sierra Leone	1	1	2	2	1	1	1	2	1
21	Gabon	2	1	1	1	1	1	1	1	1
22	North Korea	10	8	9	7	8	8	6	6	8
23	Kyrgyzstan	8	7	7	4	7	7	6	7	7
24	Benin	5	2	1	1	2	3	2	1	2
25	Comoros	8	5	1	1	2	2	1	1	3
26	Barbados	7	5	5	3	7	6	5	7	6
27	Gambia	10	8	8	9	7	7	7	8	8
28	Ghana	8	6	7	6	8	6	6	6	7
29	Guinea	7	6	2	2	4	7	4	4	5
30	Nauru	2	2	1	1	3	3	2	3	2
31	Belize	8	6	7	6	6	7	6	4	6
32	Honduras	9	7	4	3	5	7	4	3	5
33	Uruguay	8	5	4	2	5	5	3	4	5
34	Nicaragua	10	10	10	9	9	9	8	9	9
35	Paraguay	8	5	6	2	5	5	4	6	5
36	Zimbabwe	7	7	5	6	7	6	5	4	6
37	Israel	7	6	6	3	7	6	6	6	6
38	Mauritania	8	5	1	1	3	4	2	1	3
	Average scores of 38 countries	7	5	4	3	4	4	4	3	4
	Global average	7	6	6	6	4	6	7	6	6
	Discrepancy	0	-1	-2	-3	0	-2	-3	-3	-2

Source: http://www.icao.int/fsix

The airlines subject to such measures will be those operating in countries listed in Table 4.2 and Table 4.3. However, if improperly handled, it might only help aviation powers further increase their clout in the global aviation sector. Despite such concerns, international aviation safety oversight will likely be further strengthened due to international aircraft leases and the diversification in aircraft ownership structure.

Safety Paradigm Shift

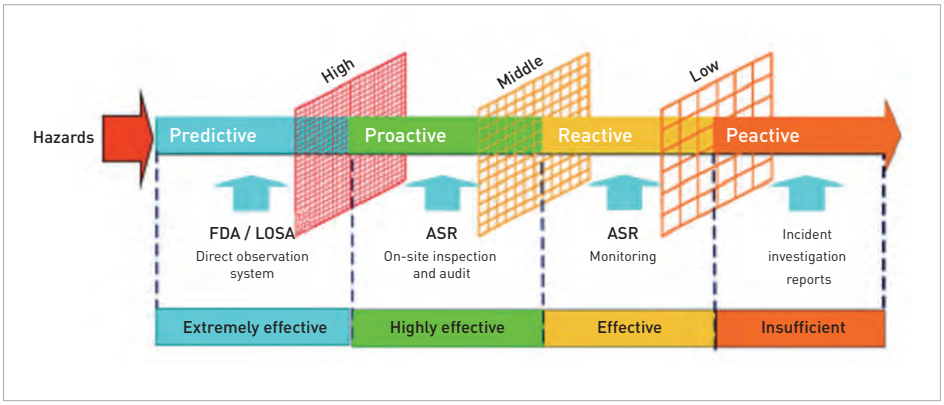
The world is now witnessing a paradigm shift in aviation safety away from emergency response to accident prevention. Conventionally, aviation safety management has been reactive in nature (Figure 4.4) relying on accident investigation reports. Now, it is undergoing a transition to predictive management that enhances the prospects for coping with risk factors more specifically. Facilitating the change requires the implementation SSP and SMS which are not being implemented in a full-fledged manner due to the lack of specific contents. In order for Korea to secure a leading position in the international aviation safety sector, it needs to employ a best practice strategy oriented toward proactive execution of SSP and SMS policies.

To ensure progress in efforts for preventive safety management, Annex No. 19 was established in 2014. The annex includes State Safety Programme, SMS, aviation safety oversight system, and safety information collection, sharing and protection policies. The new annex contents bacame international standards. The standards is reflected as core elements in a diversity of aviation safety oversight programs, helping to ensure that the paradigm shift toward preventive safety management proceeds at a rapid pace.

Concern about Lack of a Qualified Workforce

Rapid growth in global air traffic led to an increase in aviation accidents, causing a paradigm shift in air transport safety. At the same time, the rise in air traffic demand triggered concern about problems that might occur due to the shortage of qualified aviation personnel. In its first workforce demand forecast for the aviation sector, ICAO predicted annual shortages of 8,000

Figure 4.4 Conceptual drawing of the nature of safety management



Note: SSP: State Safety Programme, SMS: Safety Management System.

pilots, 18,000 aircraft mechanics and 2,000 air controllers under the current workforce training and production system.

There is also concern that the workers' lack of skills and expertise needed to handle various types of state-of-the-art airplanes and flying devices could have negative impacts on aviation safety. Various personal air vehicle, like the Terrafugia Transition, have already been developed and are waiting for a market release. The aviation sector is also seeking rapid technological advances for the manufacturing of automated aircraft and other leading-edge planes. At that, various countries are speeding up moves to introduce next generation navigation safety facilities based on satellite communication. Top-performing countries are on the verge of realizing commercial space

Table 4.4 ICAO aviation workforce demand forecast 2010-2030

Categories	2010 status	2030 forecast	Annual manpower requirements	Annual manpower production capacity	Annual manpower shortages
Pilots	463,386	980,799	52,506	44,360	8,146
Aircraft mechanics	580,926	1,164,969	70,331	52,260	18,071
Air controllers	67,024	139,796	8,718	6,740	1,978
Total	1,111,336	2,285,564	131,555	103,360	28,195

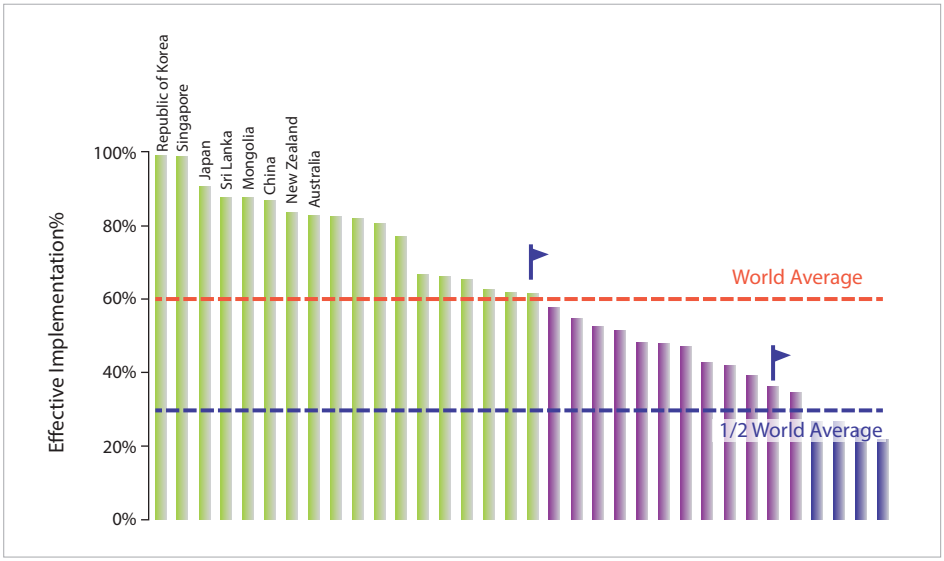
transport. Coping with such rapidly changing aviation environments requires the development of measures to secure a sufficient number of professionals in the aviation sector.

2. Domestic Environment

Overview

Korea's air traffic expanded noticeably in the 1980s and 1990s. However, due to the lack of appropriate safety management systems and standardized airport safety standards, it was classified as a Class 2 nation in FAA aviation safety evaluations. The classification led to a ban on flights of Korean flag carriers to the United States, which inflicted significant financial distress on the Korean aviation industry. Afterwards, the nation recovered through strenuous efforts. It performed superbly to the extent that it ranked first in the world in the 2008 ICAO aviation safety audit by gaining significant rating

Figure 4.5 Summarized results of the ICAO safety audit by country



scores. Korea's international prestige was also enhanced as it was elected four times in a row to the ICAO Council; 2001, 2004, 2007 and 2010. Seeking to become a Part II Council member, Korea is expanding the scope of its international activities. Also worthy of note is that Korea has retained a seat on the ICAO Air Navigation Commission, an organization that considers and recommends important matters related to air navigation services, since November 2005.

Analysis of Aviation Safety Policy through National Plans

For analysis of domestic aviation safety policies, this paper reviews the Basic Plan for Aviation Policy (2009) established pursuant to the Aviation Act, and the Comprehensive Plan for Mid to Long-Term Aviation Safety (2010) formulated as a master plan for aviation safety in accordance with the basic plan.

Basic Plan for Aviation Policy (2009)

The Basic Plan for Aviation Safety is a statutory plan established pursuant to Article 2-5 (Establishment of Master Plan for Aviation Policy) of the Aviation Act. Its contents cover environmental changes in the aviation sector, aviation policy implementation plans by goal and area, and financing measures. Aiming

Table 4.5 Policy directions and action programs presented for the aviation sector

Directions	Major tasks
Advancement in the aviation safety system	• Enrichment of the safety management system • Creation of the basis for autonomous safety management • Formulation of a mid to long-range aviation safety strategy
Technology development and infrastructure formation for the next generation air navigation system	• Technology development and infrastructure formation for the next generation aviation communications system • Technology development and infrastructure formation for the satellite navigation system • Development of core technologies for the ADS-B system for aviation surveillance • Development and formation of an integrated information processing system for air control
Efficiency enhancement of the air transport management system	• Formulation of a plan to improve the national air space structure • Formation of an electronic aviation information management system • Development of a tie point control system

to realize "proactive safety management," the plan presents the following three directions: "ensuring an advanced aviation safety system," "developing technologies for and building a next generation air navigation system," and "increasing the efficiency of the air transport management system." Based on these guidelines, it puts forth ten major tasks that need to be executed.

- **Enrichment of the Safety Management System**

Since 2006, ICAO and numerous countries have been developing and expanding the application of SMS focused on the analysis and management of latent risk factors. ICAO is seeking to firmly establish SMS international standards while the United States and the EU are exerting efforts to promote their own safety models as international standards. In order for Korea to play a leading role in the SMS field, it needs to build a performance-based integrated safety system based on its strength in the IT sector. Against this backdrop, the Basic Plan for Aviation Policy calls for the following matters: setting the safety target for advancement of the national aviation safety program, the development and application of relevant indices, formulation of a system for real-time safety level monitoring and advance risk management, expansion of the scope of targets subject to mandatory aviation safety reports, construction of a database for analysis of latent risks and error types, and the preparation of a basis for human factor analysis.

- **Creation of the Basis for Autonomous Safety Management**

The latest emphasis in aviation safety is placed on ensuring early removal of risk factors and building an effective safety management system. In order to attain these objectives, it is necessary to award airlines autonomy and induce them to act voluntarily. In this regard, the plan calls for the application of individualized safety oversight programs for airports, instead of adopting a uniform inspection program. Under this plan, airlines would be allowed to determine their own safety inspection areas, and conduct comprehensive and continuous safety checks on their own. The plan also suggests creating a reward system under which airlines would be given various incentives in case

they remain free of accidents or incidents for specific periods. For small air carriers lacking in safety management expertise, a "safety prognosis service" system is likely to be implemented.

- **Formulation of a Mid to Long-Range Aviation Safety Strategy**

Korea needs to enhance its competitiveness in aviation safety through reinforcement of relevant policy management based on systematic response to international issues and agenda. To meet this requirement, the nation should develop a proper vision and strategy while implementing systematic and comprehensive safety policies. The basic plan specifically called for the establishment of a strategy on mid to long-term aviation safety that can help analyze domestic and international issues and devise a comprehensive response system. It also proposed forming a public-private sector consultation committee for aviation safety. As of 2012, collaboration between the private and public sectors was actively underway following the establishment of the proposed committee.

- **Formation of an Electronic Aviation Information Management System**

After ICAO adopted aeronautical information management (e-AIM), a system for electronically producing and supplying aviation information, as an international standard, Korea faced the need to properly respond. The nation decided to expand its electronic aviation information management system in a way that can help users gain access to information more easily. Specifically, the Korean government decided to develop a roadmap for transition to an electronic aviation information system as well as a model for electronic aeronautical information publishing (e-AIP). It also promoted a plan to electronically produce and store information on airport operation, airspace restrictions, weather conditions, and other matters related to aviation. Additionally, it decided to provide aviation information online, via mail, and other traditional means.

Comprehensive Plan for Mid to Long-Term Aviation Safety (2010)

The Comprehensive Plan for Mid to Long-Term Aviation Safety was established in accordance with pertinent provisions of the Basic Plan for Aviation Safety, which was launched a year earlier pursuant to Article 2-5 of the Aviation Act. The plan sets seven strategic objectives and 60 important tasks that need to be implemented (Table 4.6).

Table 4.6 Seven execution strategies and important tasks

Strategic objectives	Major tasks
Enhancing the nation's aviation safety level through reinforcement of system-based safety management	• Formulating/implementing a new aviation safety program • Active collection of national aviation safety information • Expanded application of the safety management system at industrial sites • Developing an aviation accident risk forecasting model and its operating system – Making preparations to implement the ICAO continuous monitoring approach
Improving aircraft safety and securing core technologies	• Reinforcing the safety management system for aircraft operated by state organizations • Developing an advanced airworthiness system for expediting aviation technologies and enhancing safety levels • Reinforcing certification standards and procedures for aircraft maintenance structure • Building state infrastructure for aircraft safety certification
Intensifying human factors management for accident prevention	• Introducing a flight crew AQP training system • Promoting international standards for air crew certification system • Developing an education program for improvement of aviation English speaking capability • Advancement of aviation training • Support for the establishment of a training institute exclusively for low-cost carriers • Improving the flight physical examination system • Developing and implementing fatigue management criteria for flight crews • Establishing a flight training institute for production of first-rate pilots • Systematic training of the aviation workforce
Realizing objective and transparent administrative inspections and oversight	• Enacting the Aviation Safety Act to promote specialization of aviation safety affairs • Increasing the operating efficiency of the aviation safety oversight system • Building an expeditious aviation safety information supply system • Improving authorization standards and procedures for airline operation • Introducing a public notice system on airlines and aircraft with safety concerns • Amending airworthiness standards in accordance with changes in the air airline business licensing system
Strengthening safety measures for vulnerable areas in the aviation sector	• Strengthening safety management for low-cost carriers • Reinforcing the safety management system in the leisure aviation sector • Reinforcing the safety management system for hazardous air cargo transport • Introducing an environment-friendly and scientific method for repelling birds • Building a safety management system for future flying devices such as unmanned aircraft and personal air vehicles • Research on basic structure of future aerospace transportation

Table 4.6 Seven execution strategies and important tasks

Strategic objectives	Major tasks
Building a future-oriented high-safety, high-efficiency air traffic control system	• Preparing the basis for a future air transport system (Smart Sky) • Building a performance-based navigation system • Improving environments for using flight areas • Reinforcing air traffic control risk management • Promoting the construction of a second air transport center • Developing a program for airspace evaluation and flight procedure design • Developing an airport control simulator • Building an air navigation system for small aircraft • Building an electronic aviation information management system • Laying the basis for information service for low-altitude visual flight navigation • Promoting a plan to build a multi-purpose satellite navigation system for Korean airspace • Pursuing a plan to build a 4D real-time flight control system • Building a future-oriented international aviation safety communications networking neighboring countries • Building a comprehensive navigation safety facility control system • Developing highly sophisticated approach control radar facilities • Modernizing airport landing and take-off facilities • Improving the capacity of air navigation facilities • Building a navigation-based platform system (ANS-SWIM) • Establishing a center for certifying navigation safety facilities • Pursuing airport facility improvement projects • Installing an automated system for managing obstacles around airports • Improving the airport safety management monitoring system
Building a public-private sector knowledge network and intensifying international cooperation for aviation safety	• Building a continuous civil aviation safety cooperation system • Promoting a plan to establish an aviation research institute • Increasing Korea's clout at ICAO • Reinforcing global aviation partnership • Formulating a civil aviation currency protection program among Korea, China and Japan • Aiming to become a top-5 nation in manufacturing of navigation safety facilities • Intensifying civilian-military navigation system cooperation • Enhancing Korea's advanced status in aviation through expansion of training programs for developing countries

• Formulating and Implementing a New Aviation Safety Program

With ICAO contracting states required to implement a state safety program based on international standards beginning in November 2010, Korea needed to develop its own model for application in safety management. The comprehensive plan called for the establishment and implementation of a national aviation safety program with participation of all relevant government ministries. The program would cover the following matters: safety targets, safety activity planning, information collection and analysis techniques, information quality management, early detection of risk factors, and a risk management system

The plan also proposed developing risk indicators and aviation safety

indices for measuring and monitoring the danger level of air transport. In addition, it suggested pursuing the sophistication of the aviation safety information system in order to ensure scientific and statistics-based performance of safety management affairs.

- **Active Collection of National Aviation Safety Information**

The traditional aviation safety policies greatly contributed to accident prevention by focusing on improvement of facilities, equipment and oversight measures after the occurrence of problems. However, they had their limitations in ensuring continuous enhancement of safety levels by considering future air transport demand. So, it became necessary to actively promote a system that would allow the collection of various types of on-site industrial information and to exert efforts for information integration, analysis, and quality improvement. Against this backdrop, the plan proposed laying the basis for "just culture" that would help facilitate the practice of making safety reports (mandatory and autonomous reports) among people working in the aviation sector. It also suggested promoting a codification project designed to ensure systematic management and analysis of various types of dangers and errors. Additionally, it called for capacity improvement of online reporting systems in order to increase convenience for those making reports and reinforce the functions for statistical analysis. Other proposed measures include the publication of an analysis report on safety hindrance occurrence statistics and other aeronautical safety trends, and promotion of a memorandum of understanding to increase cooperation on information exchanges with airlines, airport corporations and related industries.

- **Making Preparations for the ICAO Continuous Monitoring Approach**

ICAO implemented USOAP from 1998 through 2010 and is considered to have been noticeably effective in reducing global aviation accidents. Based on its decision to make a shift toward a low-cost, high-efficiency audit method, the organization implemented the continuous monitoring approach in a full-fledged manner beginning in 2013. The new approach

is designed to measure the safety level of a country based on data on such matters as the international standard implementation ratio, the occurrence of accidents and incidents, and core safety management elements. On-site oversight activities are conducted for countries found to have safety concerns. ICAO formed an advisory group composed of 20 countries, including Korea. Group members were asked to help by offering advice in relation to the new-concept audit method and participating in field tests. With regard to CMA the comprehensive plan proposed the following matters: implementation of research on response strategy, appointment and notification of CMA coordinators, participation in on and offline conferences, establishment of a dedicated organization, and formulation and implementation of a comprehensive action program.

• **Building an Expeditious Aviation Safety Information Supply System**

Preventing plane crashes required efforts to establish a system that can help people working in the aviation sector or related industries expeditiously gain information on the types and causes of aviation accidents and incidents as well as related recommendations. So, the plan suggested introducing an "aviation safety alert" system designed to help the Ministry of Land, Infrastructure and Transport speedily provide national flag carriers with information on various types of errors committed by flight crew and aircraft deficiencies as well as recommendations. It also called for the opening of a dedicated website to ensure expeditious information sharing as well as the construction of a relevant database.

• **Building the Aeronautical Information Management System**

With the adoption of the Aeronautical Information Management system[3] as an international standard at the 36th ICAO Assembly in September 2007, the contracting states were required to provide aviation information using ICAO's standard electronic formats. Domestically, the process of developing a roadmap for introducing the electronic aviation information management system was completed in December 2009. The plan called for phased

construction of an electronic production management program for aviation information under the control of the Ministry of Land, Infrastructure and Transport between 2010 and 2013. Beginning in 2014, the program was expanded to cover information under the control of other organizations (electronic obstacles/geography information of airport corporations and aviation weather information of the Korea Meteorological Administration).

- **Increasing Korea's Clout at ICAO**

The plan called for efforts to develop efficient agenda topics and turn them into international standards. It also proposed implementing various activities to increase Korea's status at ICAO. Specifically, it put forth the following programs: development of a program for systematic management of international aviation issues and policy topics, reinforcement of the research structure (expansion of the pool of experts, construction of a knowledge network involving industries and universities, phased increase in agenda development funds that amounted to 300 million won in 2011), establishment of a system designed to more effectively determine the Korean government's positions on major ICAO policies and deliver them to the permanent Korean delegation to the organization, and implementation of activities aimed at increasing Korea's influence at ICAO.

3) Aeronautical Information Management: a system to build an integrated electronic production and management program for six kinds of aeronautical information and provide such information to pilots and other users (aeronautical information publication, notice to airmen, flight information notice, airport map, obstacle map, etc.).

Section 2

Evaluation of Achievements and Major Aviation Safety Policies

1. Overall Achievements

Whenever major accidents involving Korean air carriers occurred in the past, the Korean government would announce special measures designed to improve aviation safety. Such measures, however, were focused on short-term improvements. Fundamental problems with the nation's aviation safety system could not be addressed properly from a long-term perspective. In addition, safety oversight by the government relied on inspections implemented without considering diverse conditions of airlines. The government also concentrated its efforts on just preventing an increase in the number of accidents. Under these conditions, it was difficult to promote a safety management culture within air carriers. In an effort to tackle these problems, the government began to devise the Aviation Safety Technology Development Plan in accordance with Article 37-2 of the Aviation Act. It also promoted the Aviation Safety Program in accordance with Article 149 of the Aviation Act and the Basic Plan for Aviation Safety and Security pursuant to Article 9 of the Aviation Safety and Security Act.

After the FAA downgraded Korea to Category 2 safety rating in 2001,

the Korean government exerted systematic efforts to improve the nation's aviation safety level in cooperation with airlines, airport corporations and relevant academic groups. It formed a separate organization to take charge of aviation safety affairs and launched the aviation safety investigation committee under the Ministry of Land, Infrastructure and Transport. Aiming for no air traffic fatalities for ten consecutive years, the government reshaped the pertinent legal framework. Further, it established the Aviation Safety Program and formulated implementation standards of the Safety Management System for airports, airlines and air controllers.

As a result of these efforts, Korea received near-perfect scores in the 2008 ICAO aviation safety audit implemented over eight categories (laws, organization, certification, navigation, airworthiness, flights, airports, and accident investigation). In the audit, the nation was authorized for implementing 98.8% of the international standards required by ICAO. Kora also recorded no aviation deaths for a 10th consecutive year. These achievements helped Korea gain international reputation as a first-rate country in the field of aviation safety.

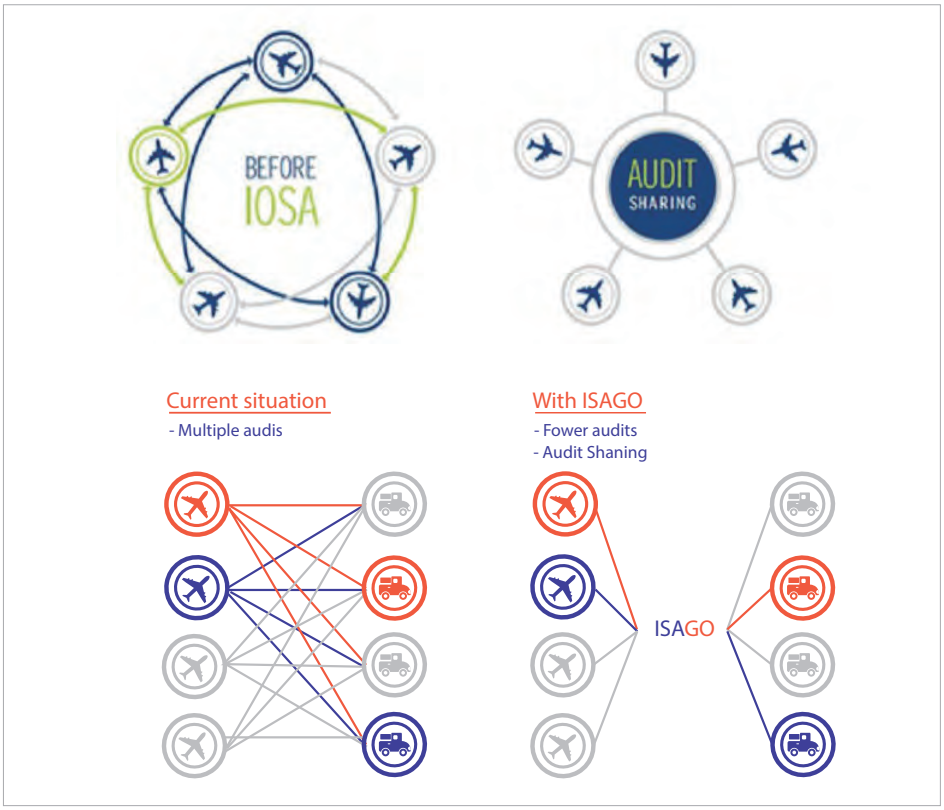
Korea's successful performance in the 2008 ICAO audit provided further momentum for the nation to strengthen its aviation safety system. It placed particular emphasis on safety oversight specialization and international standardization, objectives pursued by ICAO.

- ICAO: Global Air Navigation Plan, Universal Safety Oversight Audit Program, National Aviation Safety Program, Safety Management System, etc.
- IATA: Six-Point Safety Program, Safety Management System, Safety Trend Evaluation, Analysis & Data Exchange System, etc.

Based on its advanced IT, Korea developed Standards and Recommended Practices (SARP) Management and Implementation System (SMIS)[4] for the

4) Database-based system developed by the Aviation Safety Headquarters in 2006 to help manage the implementation of about 10,000 SARP in preparation for ICAO USOAP targeting its 190 contracting states. The system has been supplied to numerous countries.

Figure 4.6 IATA aviation safety program



first time in December 2005, exerting efforts for its promotion and adoption as an international standard. In a related move, KOTI has been developing ICAO Continuous Monitoring Approach (CMA) support systems since 2011 including SARP Management and Reporting Tools (SMART) and Total Oversight Management System.

Korea is also implementing a "comprehensive aviation safety information disclosure system" targeting all relevant organizations, including airlines, airports, and the government. It is designed to firmly establish an aviation safety culture by increasing the public right to know such information and promoting aviation safety through market functions. New airlines are subject to rigorous inspections before gaining air operator certification and thorough safety checks after staring their operations. Safety oversight is also being

Figure 4.7 Safety Oversight Management System

Figure 4.8 SARP Management Implementation System

strengthened for overseas airliners operating routes to Korea. For workforce training, Korea has relied on overseas countries including the United States and Australia due to Korea's insufficient training structure. The nation is predicted to suffer a shortage of 1,600 pilots over the next five years. Consequently, the nation will have to use foreign institutes for pilot training at considerable cost.

There are also calls for improvement of airspace infrastructure. The Korean airspace is controlled by the military, so it has not been used in a flexible manner. The conventional air traffic control method based on voice communications has been proved to have limitations in accommodating the ever-expanding air traffic volume or ensuring safety. In this regard, continuous efforts ought to be made to improve the airspace operating scheme and upgrade the navigation safety facilities and the air traffic control system, thereby helping promote continuous growth of the nation's air transport industry. In November 2005, Korea signed a bilateral aviation safety agreement with the United States to facilitate improvement of legal framework, workforce training, and technology support for pertinent businesses. In addition, the government formulated safety management measures for light aircraft and ultralight flying devices. Korea promoted

training programs for aviation personnel jointly with ICAO and held seminars, thereby enhancing its international prestige and cooperative ties in aviation safety and related technology fields.

2. Major Aviation Safety Policies

While pursuing a shift in its global aviation safety policy, Korea is aiming to get upgraded to Aviation 4.0[5]. To attain this objective, it has set three targets: establishment of a continuous CMA response system, development of policies from global perspectives and reinforcement of international cooperation, and maintenance of the top-level safety rating.[6] The specific tasks are presented in Table 4.7. Through implementation of these policies Korea is seeking to turn itself from a technology recipient to a donor, establish itself as a nation free of aviation incidents, and pursue growth as an aviation power with global competitiveness.[7]

Table 4.7 Objectives and tasks for upgrade to Aviation 4.0

Objectives	Tasks
Establishment of a continuous CMA response system ⇨ Use of IT sector strengths for aviation safety	• Continuous management of implementation of international standards • Continuous management of audit-related data • Self-evaluation/reinforcement • ICAO online system management (SMART/i-STAR/OASIS)
Development of policies from global perspectives/Reinforcement of international cooperation ⇨ Take the initiative in determining international policies	• Policy agenda development/Reinforcement of initiative on international stage • Reinforcement of GASP/Asia-Pacific Aviation Safety Group agenda management • Management of trends of international safety evaluations by ICAO/FAA/EU/IASA • Strengthening technological cooperation with advanced countries
Maintenance of the top-level safety rating ⇨ Balanced development between technology and safety	• Systematic management of the Aviation Safety Policy Plan • State Safety Programme/SMS enrichment • Laying the basis for technology support related to civilian aircraft safety (securing core technologies) • Forming a knowledge network involving the government, industries, universities, and research institutes

Source: Ministry of Land, Transport and Marine Affairs, Public-Private Sector Joint Workshop for Response to USOAP-CMA, February 2012.

Strengthening International Cooperation in the Aviation Safety-Related IT Sector

ICAO pursues international sharing of information via documents, databases and websites. Through such means, it is also managing the implementation of international standards. The organization is currently offering various related services through about 450 web pages and 70 systems. However, it is facing numerous difficulties, particularly those related to the increase in demand for system upgrades, amid rapid advances in IT and ever widening service ranges. To address this problem and offer better services to the international community, ICAO is pursuing the establishment of an IT system that can ensure its contracting states' online access to aviation safety information and services.

ICAO classified its aviation safety-related data into three categories: standards and recommended practices, aircraft operations, and geo-referencing data. After completing the classifications, it asked contracting states to render assistance in building IT systems needed for each category.[8] The resulting systems are SMART, Online Aircraft Safety Information Service (OASIS), and GIS-related tools. As their aim is to become international standards, it is very important to play a part in building these systems. Korea's participation in these projects will help the nation secure an advantageous position in determining relevant international standards. It will also help Korea improve its chances of advancing to a higher-level ICAO Council and lay the basis for opening export markets for domestic aviation safety technology. China, which is also aware of such benefits, is implementing

5) This is not a generally accepted concept. It is used to refer to aviation safety policy changes that have been taking place since 2012. The original document classified the aviation-related periods as follows: 1.0 (-1990), 2.0 (1991-2001), 3.0 (2002-2011), and 4.0 (2012-Present).

6) Public-Private Sector Joint Workshop for Response to USOAP-CMA, February 2012, Ministry of Land, Transport and Maritime Affairs.

7) Ibid.

8) International Civil Aviation Organization, Improved Access to Safety Data (ICAO Working Paper, A-37-WP/71, 37th Assembly Session, Technical Commission.

a project to build OASIS. Korea offered to provide technological support for the construction of SMART[9] by using its technological expertise and experience it has accumulated when developing the electronic safety tool SMIS. ICAO accepted the offer and Korea began to participate in the SMART project in March 2011. The Ministry of Land, Infrastructure and Transport and the Korea Transport Institute are jointly responsible for the SMART project in Korea.

Table 4.8 ICAO-proposed electronic safety systems

Tool	Function and/or information available	Benefits
SMART	E-state letter consultation	• Sharing views with others on the amendment of new SARP and PANS (Procedures for Air Navigation Services)
	Annex management	• Management and publication of Annex amendments
	Electronic filing and publication of differences	• Easy and real time access to global compliance and/or differences to SARP
OASIS	Designators for aircraft operating agencies, aeronautical authorities, and services (Doc 8585)	• One-stop access to safety data related to aircraft and air operators • Entry, modification, and validation of data at source
	Aircraft type designators (Doc 8643)	
	ICAO aircraft information system	
	Register of air operator certificates	
Gis-related tools	Integrated set of geo-referencing safety data with potential hazards	• Increased situational awareness of the global and regional safety levels • Real-time access to quality assured geo-referencing data
	Air navigation plans	
	Location indicators (Doc 7910)	

Korea and ICAO held working-level cooperation talks on some modules of the SMART system. In May 2012, the two sides entered into a memorandum of understanding to facilitate Korea's support for the ICAO project to build the electronic systems. The MOU was signed between the secretary general of ICAO and the head of the Korean Aviation Policy Office. At the same time, an annex on the SMART project was signed by the ICAO

9) International Civil Aviation Organization, Consideration of ICAO's New Safety Initiative for Safety Information Sharing in Electronic Tools, A37-WP/236, 37th Assembly Session, Technical Commission.

Air Navigation Bureau, Aviation Policy Department, and KOTI.

As a result of these efforts, the offline functions of the compliance checklist module developed by Korea were implemented in the SMART system on September 17 and began to be used by ICAO contracting states. Korea is also participating in a project to develop various modules for the implementation of USOAP-CMA slated for 2013. In particular, Korea has developed Planning and Scheduling Tools for on-site safety audit planning and management currently implemented on a pilot basis jointly by Korea and ICAO.

In order to ensure that such cooperation lead to a long-term aviation safety enhancement project, a cooperative structure has been established among ICAO, Ministry of Land, Infrastructure and Transport, and KOTI. In this process, ICAO and KOTI began operating the Team Foundation Server using a bidirectional virtual private network, the first of its kind in the world. It was regarded as a most basic and physical example of achievements made through the cooperation between Korea and ICAO. Based on such a physical network as well as the experience and human network it has gained through cooperation with ICAO, Korea will be able to make significant contributions to the enhancement of global aviation safety.

Ensuring Systematic Safety Management in air transport business

For systematic safety management of air transport business, Korea has built SMS, implemented various measures designed to improve the organization culture, expand the targets for safety oversight, and intensified oversight for foreign low-cost carriers that fly to Korea.

For enhancement of efficiency in safety management, Korea pursued the establishment of SMS. In a related development, the government developed an SMS operation manual in December 2007 to help airlines devise and implement their own aviation safety management systems. It also developed an electronic system for management of 49 safety indicators. For three months from December 2010 to March 2011, the government checked the SMS implementation status of the six national flag carriers.

The government also executed a project to improve the safety reporting system in order to improve the related organizational culture. Specifically, it established a comprehensive execution plan for the improvement of the report system in August 2009. Two months later, the improved electronic reporting system (ASMRS) began operation.

Safety oversight, which had focused on scheduled air transport business operators, was expanded to cover non-scheduled and aircraft use business operators as well. In a related move, the government began implementing autonomous safety inspection system for airlines in March 2010. It also promoted an oversight program designed for the four low-cost carriers.

The government also strengthened safety management for foreign-based low-cost carriers. In July 2008, it devised safety regulations foreign LCCs should meet before operating in Korea. In April 2010, the government introduced a safety rating system for foreign LCCs. It also revamped the ultralight aircraft management system in order to cope with the increased use of leisure sport aircraft. It also promoted the amendment of relevant provisions in the Aviation Act.

Developing and Modernizing Airport and Navigation Safety Facilities

For enhancement of aviation safety, the government promoted the development and modernization of airport and navigation safety facilities. Specifically, it launched a project to install or modernize the facilities at the Pohang, Anyang and Gangwon VOR/TAC as well as the air navigation facilities at the U.S. airbase in Osan. The government also installed precision approach radar facilities at Pohang Airport and navigation facilities (ILS/DME, VOR/TAC) at Uljin Airport and modernized the instrument landing facilities (LLZ/DME) at Daegu and Yeosu airports.

In addition, the government implemented the following projects aimed at expanding the navigation infrastructure: introduction of a next generation air control system (ADS-B) for Incheon International Airport, development and establishment of a next generation air communications network

(ATN/AMHS), pilot implementation and construction of a Korea-China air communications network (ATN/AMHS), and development of a public satellite navigation communications system.

In order to secure the basis for airport operation through cooperation between the military and the civilian sectors, the government improved airport facility and design standards, and amended airport usage agreements and operating guidelines. Military-civilian joint safety checks were also conducted.

For the expansion and efficient operation of weather forecast networks, antiquated weather facilities were replaced with new ones at Incheon, Gimpo, Gimhae, Yeosu and Muan airports. This project was implemented jointly by the Ministry of Land, Infrastructure and Transport, Incheon International Airport Corporation, and Korea Airports Corporation.

Improving Korea's Safety Management Capacity and Reliability through International Cooperation

In order to intensify its international status through overseas exchanges, Korea has actively participated in ICAO's international aviation cooperation projects and provided relevant support. It has also taken part in various multilateral and regional cooperation programs, and rendered assistance in promoting SMIS. As part of efforts to ensure safety management through cooperation with relevant industries, it promoted the development of 4-seater aircraft, a prototype for light sport aircraft, aircraft maintenance techniques, and a system for forecasting and analyzing aviation accident risk factors.

Comprehensive Measures to Cope with Continuous Monitoring of Aviation Safety (USOAP-CMA)[10]

Korea ranked first in the world in the 2008 ICAO audit. It is now exerting

10) Based on Public-Private Sector Joint Workshop for Response to USOAP-CMA, Ministry of Land, Transport and Marine Affairs, February 2012.

great effort to retain the top-performing status in the continuous monitoring-based audit (USOAP-CMA) was implemented beginning in 2013. As part of the efforts, Korea formulated comprehensive preparatory measures aimed at "ensuring thorough implementation of international aviation standards, thereby maintaining Korea's reliability in terms of aviation safety and eventually helping the Korean air transport industry improve its international competitiveness."

Under this objective, the government is implementing the following strategy and action programs:

① Reorganization of the Domestic Legal Framework Based on International Standards

- Amendment of laws and regulations based on comparative analysis of domestic and international standards: revising aviation-related laws and regulations in a way that can meet international standards
- Complete correction of deficiencies through thorough advance examination: detailed checks to confirm whether international standards have been met in eight core audit categories (basic laws, specific regulations, aviation organization, capacity development education, technical guidelines, licensing/certification, safety oversight, and problem resolution)

② Reinforcement of Basic Data from the Pre-Audit Monitoring Stage

- Thorough examination of basic audit materials and reinforcement of danger indicators management: monitoring industrial danger indicators such as accidents/incidents, traffic volume, and the number of registered aircraft, as well as foreign audit trends and performance of quarterly risk management
- Promoting ISO certification in relation to the quality of aviation safety

③ Making Up for Insufficient Aviation Safety Infrastructure

- Laying the basis for providing support in terms of aircraft safety technology: analysis of civil aircraft deficiencies and development of plane crash prevention technology, etc.

- Oversight personnel reinforcement for enhancement of accident prevention

④ Building a Pan-Governmental CMA Response System

- Devising a manual for maintaining a CMA response system: Establishment of a responsible management system using the Ministry of Land, Infrastructure and Transport's international standards management system (SMIS)
- Building a public-private sector response system and holding relevant workshops

Section 3

Future Aviation Safety Policy Directions and Tasks

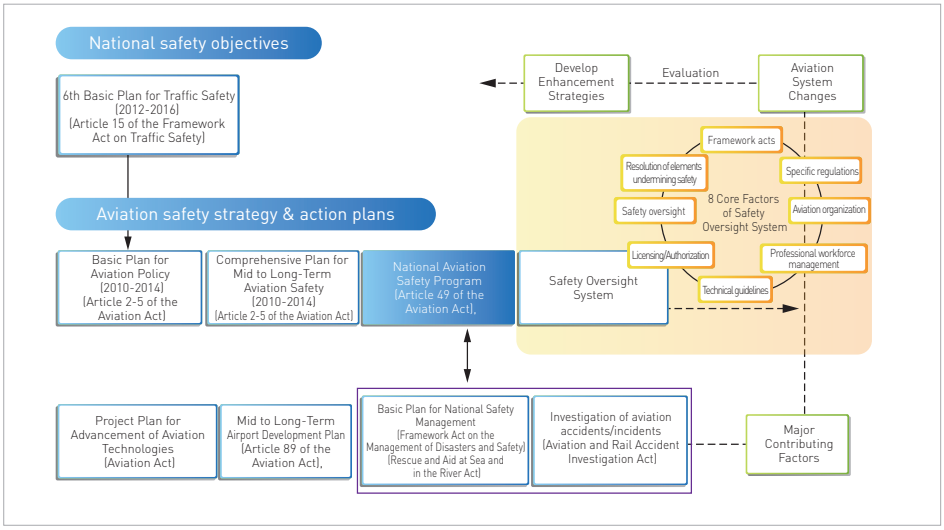
In 2001, Korea faced a crisis related to its aviation industry as it was downgraded to Category 2 in the FAA safety evaluation. However, this misfortune was turned into a blessing as the concerted efforts helped to it ranked first in the world in the 2008 ICAO audit (USOAP) by receiving extraordinarily high scores. Such an achievement was made possible as the nation expeditiously responded to changes in the global aviation environment while making strenuous efforts to correct its deficiencies.

As of 2012, ICAO and other related international organizations have been pursuing a new global safety system that would function in an integrated and organic manner. The work is to implement aviation safety policies aimed at intensifying international oversight, ensuring transition toward preventive safety management, and promoting information sharing between ICAO and its contracting states. In order to help Korea effectively respond to such developments, this paper presents the following implications.

1. Increasing Connectivity among Core Elements of State Safety Programme /SMS

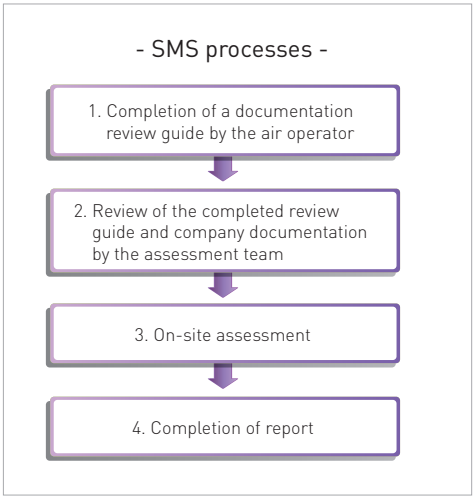
Korea is implementing its state safety program (SSP) through various plans (Figure 4.9) and seeking to introduce safety management system (SMS) processes.

Figure 4.9 Various aviation safety policy plans



Research shows that confusion could be caused in the process of implementing the various safety plans because of the lack of common goals and connectivity. With regard to SMS, research points to the need for increasing the efficiency of monitoring and safety performance through improvement of the safety targets/indices and the matrix for assessing risk levels. Additionally, further research needs to be carried out to find out

Figure 4.10 Safety management system conceptual drawing



ways to ensure effective connections between the existing safety oversight scheme and State Safety Programme / safety management system now being promoted.

2. Need to Secure Sovereign Rights Regarding Aviation Safety Information

The international trend toward intensifying aviation oversight through the sharing of air transport information is affecting all countries; Korea is no exception. Korea needs to extensively examine the impacts the international information sharing scheme will have on the nation's aviation industry. Aviation safety information is a vital element that can determine the aviation level of a nation. Depending on the securing of such information, one nation can claim supremacy over another. In this respect, the question of ensuring sovereignty must be taken into account when dealing with this issue. As manifested by the difficulties Korea suffered years ago after being categorized

Figure 4.11 Global Aviation Information Network's information sharing system

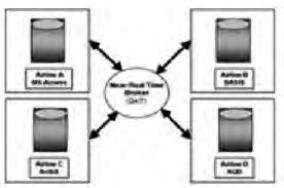
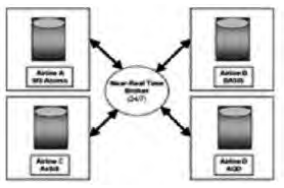
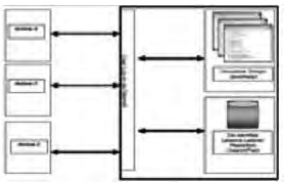
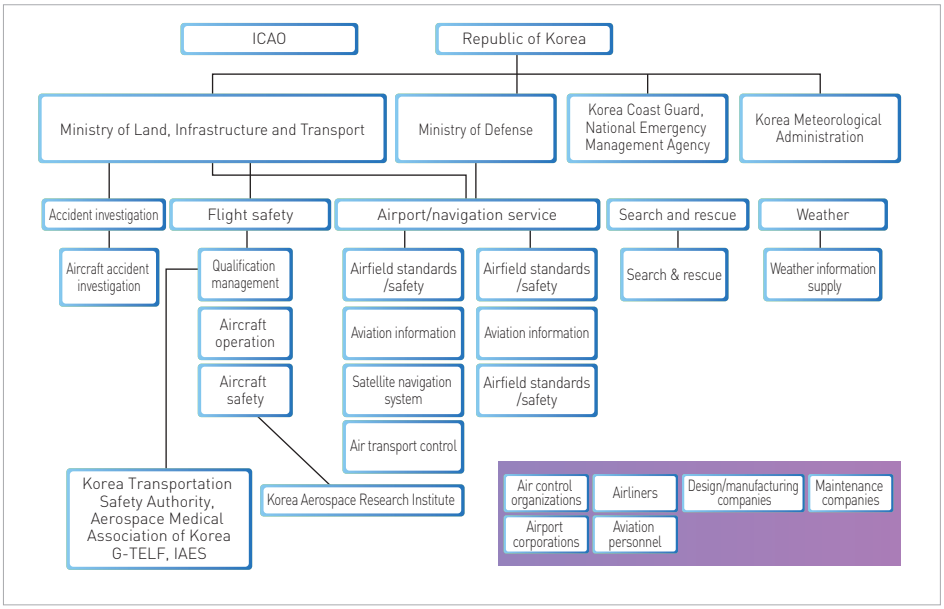
Near Real-Time Sharing System		• Transmission and reference of accident/incident information between mutually trusted groups via the internet without being restricted by time • No need for central storage equipment for data aggregation • Linkage with various aviation safety systems via near real-time broker • Sharing of current information with minor delay
Periodic Integration and Analysis System		• Each airline sends standardized data to integrated DB after removing their company ID. The DB integrates the data and sends the integrated data back to each airline • Airlines can compare their safety data with the integrated trend data
Lessons and Corrective Actions System		• Airlines share their accumulated safety knowledge through the Lessons and Corrective Actions System • Information includes upper-level detections other than direct accident data, quality deficiencies not associated with accidents, and knowledge related to each organization's hazards)

Figure 4.12 Domestic aviation safety information sharing system



as a Class 2 country in the FAA evaluation, it is extremely important for the nation's aviation industry to secure international reliability on its safety capacity. ICAO, which proposed building an information sharing system called Global Aviation Information Network in 2000, is now pursuing a new-concept information sharing system (through the application of open XML), as outlined in Figure 4.11.

In order to establish such a strategy and plans related to aviation safety information, Korea needs to secure a domestic aviation safety information sharing system (Figure 4.12). The nation has significant information related to aviation safety, but it is lacking an organization that manages it in an integrated manner. The lack of such an organization may make it difficult for the nation to effectively respond to the international trend of information sharing. In addition, the nation needs to build a database that can contain the monitored data.

3. Reinforcement of the Organic Aviation Safety Management System

Korea's aviation system, which has been examined in this paper based on ICAO annexes, is outlined in Figure 4.12. The system represents a pan-governmental structure formed with the participation of the Ministry of Land, Infrastructure and Transport, Ministry of Defense, Korean Coast Guard, National Emergency Management Agency, and Korea Meteorological Administration. In practice Ministry of Land, Infrastructure and Transport plays a central role in performing aviation safety management. However, various problems can occur because of conflicts or differences in views among relevant organizations. Under the current structure, it also seems difficult to respond to important developments in a timely and flexible manner. A manual has been created to help the government expeditiously respond to plane crashes. However, there is concern that the government may encounter difficulties in responding to ICAO's continuous monitoring approach implemented in 2013.

In order to prevent such difficulties, Korea needs to build an aviation safety management system in a way that can ensure organic cooperation among relevant agencies. The system should be based on the concept of business continuity planning[11] so that maximum efficiency can be ensured.

11) A system designed to ensure speedy recovery in the event of accidents or disasters based on business performance analysis, risk factor evaluation, establishment of emergency plans, and through advance education and training.

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Chapter
05

Aviation Security Policies

Section 1

History of Domestic Aviation Security Incidents and Acts of Unlawful Interference

1. Domestic Aviation Security Incidents

On February 16, 1958, a Korea National Airline (predecessor of Korean Air) plane was diverted to North Korea by seven hijackers while en route from Busan to Seoul. It marked the first aircraft hijacking in Korea and one of the seven major domestic aviation security incidents that have been reported so far. The seven cases, which occurred between 1958 and 1987, caused 390 casualties and 30 injuries. The seven unlawful acts can be broken down into the following categories: three hijackings (43%), one airplane exploded (14%), two missile attacks (29%), and an airport attack (14%). Security lapses and negligence in conducting passenger ID checks were blamed for the three aircraft hijackings, which occurred between 1958 and 1971. The 1987 destruction of KAL Flight 858 as a result of a terrorist attack was blamed on failure to conduct security checks on transit passengers during a stop-over at Abu Dhabi Airport.

2. Acts of Unlawful Interference

Acts of unlawful interference directed against Incheon International Airport took place 28 times from 2005 through May 2010. They were mostly threats made over the phone or the internet. No human casualties or facility damage was reported in relation to these acts. However, they caused delays or interruptions in airport and flight operations and inconvenience to passengers. During the above-mentioned period, the occurrence of such interference acts against Incheon International Airport peaked in 2009. Specifically, the airport received four bomb threats, six threats of aircraft bombings, two hijacking threats, and a threat of an inbound passenger with explosives. As shown in Table 5.1, the number of prohibited items detected at the airport is on the rise.[1] Ammunition accounts for over half of the detected items.

Table 5.1 Statistics on prohibited items detected at Incheon International Airport

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of detections	78	115	92	138	167	202	218	254	286	387	390	438	389

Acts of unlawful interference targeted at other Korean airports were also primarily threats made over the phone or internet. The airports involved are Gimpo, Gimhae, Jeju, Daegu, Gwangju, Ulsan, Cheongju, Yangyang, Yeosu and Mokpo under the operational control of Korea Airports Corporation. During the above-mentioned 2005-2010 period, these airports received a total of 52 threats of explosion or other acts of violence. They did not lead to any direct damage such as casualties or facility destruction but did result in passenger inconvenience caused by interruptions or delays in airport or flight operations. Statistics compiled between 2003 and 2010 showed ups and downs in the number of detections of prohibited items such as firearms

1) Firearms, ammunition, swords, stun guns, gas spray guns, etc. were detected at the airport. Statistics represent the cases in which the items were surrendered or the owners were referred to pertinent investigative authorities.

and ammunition. The number was conspicuously high at Gimpo Airport, the passenger traffic of which is much higher than that of other airports.

By air transport operator, Korean Air reported 334 cases involving unruly passengers between 2003 and 2010. Drunken passengers causing safety risks made up 99 cases, taking the largest share. Of the remaining cases, 83 were categorized as other unruly conduct (smoking, etc.), 73 disruptive acts included abusive words or loud singing, 52 as the use of violence or threats, and 17 as behavior that causes crew or passengers to feel sexual shame. During the same period Asiana Airlines reported 65 cases of disruptive behavior on aircraft. Of them, 20 were for violence or threats, 12 for abusive words or loud singing, 13 for risks posed by drunken passengers, seven for

Table 5.2 Domestic aviation security incidents

Date	Overview	Explanation
February 16, 1958	KNA plane named Changrang was diverted to North Korea after being hijacked and rerouted to Pyeongtaek by seven hijackers during its scheduled flight from Busan to Seoul	Of the 26 abducted passengers and crew members, the crew and one child were detained in North Korea
December 11, 1969	Eleven minutes after take-off, Korean Air Lines Flight YS-11 bound for Seoul from Gangneung was hijacked by a North Korean agent and forced to fly to Pyongyang	Thirty-nine passengers were later returned to South but eight passengers and crew members along with the aircraft were held in North Korea
January 23, 1971	Korean Air Lines Flight F-27 flying from Sokcho to Seoul with 60 occupants was hijacked by a man armed with hand grenades. A hand grenade exploded during a fight between the man and a security agent aboard the aircraft. The damaged plane was crash-landed on a Gangneung beach by a trainee pilot.	Two deaths
April 21, 1978	A Korean Air Lines B707 departed from Paris for Anchorage with a stopover in its scheduled flight to Seoul, carrying 97 passengers. It went off course due to navigation error and entered the Soviet airspace. Hit by missiles fired by two Soviet fighters, the plane made an emergency landing on a Murmansk river.	Two deaths, 13 injuries
August 1, 1983	While en route from New York to Seoul via Anchorage, Korean Air Lines B747 airplane carrying 269 passengers and crew strayed into Soviet airspace. After being intercepted by six Soviet fighters, it was shot down by missiles fired by two MiG-23 fighters.	269 deaths
September 14, 1986	A bomb planted in a trash can exploded at Gimpo International Terminal (now used as the domestic flight terminal). The explosion was described as an act designed to disrupt the Seoul Olympic Games.	5 deaths, 32 injuries
November 29, 1987	Korea Air B707 exploded in the sky over Myanmar. The explosion was caused by C-4 explosives planted by North Korean agents.	115 deaths

behavior that caused crew or passengers to feel sexual shame, and 13 for other disorderly acts. Except for 2004 and 2005, the number of passengers reported for unruly behavior on aircraft was about six a year on average.

Section 2

Domestic Legal Framework for Aviation Security

Since the 9/11 terrorist attacks, Korea has implemented "reinforced aviation security measures" aimed at enhancing the nation's aviation security system and preventing international terrorist acts or hijacking attempts against Korean aircraft or airports.

1. Reorganization of Aviation Security Laws and Systems

The government has intensified efforts to combat international terrorism that use increasingly high technology, sophisticated means, and seeks to maximize its impacts through large-scale attacks. In particular, to prevent unlawful acts of interference on aircraft as well as airplane hijacks, the government has introduced an aviation security inspector system designed to identify security weaknesses through on-site checks. In a move to strengthen its audit and surveillance functions, the government established the Aviation Security Division within the Aviation Safety Headquarters on August 12, 2002. Now within the Ministry of Land, Infrastructure and Transport, the division is responsible for the following affairs: enactment and revision of laws related

to aviation safety and security, establishment of aviation security policies, policy coordination among relevant ministries, formulation of basic plans for aviation security and safety, establishment of security audit plans, operation of the aviation security system (As of 2012, there were 28 inspectors in service under the system, which was introduced on October 25, 2002), and cooperation with international organizations and foreign governments in the area of aviation security.

In 2002, the government proclaimed the Aviation Safety and Security Act based on comprehensive amendment of the Aircraft Flight Safety Act. The move was aimed at building an aviation security system that meets international standards strengthened following the 9/11 terrorist attacks, reorganizing the legal and institutional framework for civil aviation security, ensuring systematic management of civil aviation security affairs, and implementing ratified international treaties.

The purpose of Aviation Safety and Security Act is to prescribe standards, procedures and obligations to prevent any unlawful act in airport facilities, air navigation safety facilities and aircraft to ensure the safety and security of civil aviation. The Act clarified the responsibilities for conducting security screening on passengers, baggage and cargo. It stipulated that airport operators (Incheon International Airport and Korea Airports Corporation) take over the business of screening passengers, transit passengers, and carry-on and checked baggage from air transport operators. In return, the air transport business operators were given the authority to conduct air cargo security checks. In addition, the Act provided the basis for expanding the power of aviation security inspectors concerning surveillance and examination. The Act was partially amended later to clarify the responsibilities of air transport operators and cargo terminal operators for ensuring security management of cargo terminals, as well as to meet international standards on the prevention of prohibited liquids from being carried onto airplanes.

In 2003, the government established the National Aviation Security Contingence Plan designed to effectively counter acts of unlawful interference

and threats against airport facilities and civil aircraft. In 2005, it began to use five color codes (green, blue, yellow, orange, red) instead of three to depict the current risk of terrorist activity, and devised a manual on steps people should take to respond to each threat level.

In 2009, the government established the Mid-Term Development Plan for Aviation Security Policy to build an advanced aviation security system and systematically promote international cooperation for joint response to aviation terrorism. In accordance with the plan, it began to implement 22 tasks in five areas for the improvement of legal, organization and operation systems. In 2012, the government began promoting the enactment of the Aviation Safety Act. In order to prevent confusion caused by similar titles, it also decided to amend the Aviation Safety and Security Act and change its title to the Aviation Security Act. The amended law would include provisions for an "aviation security autonomous reporting system" as well as new disciplinary regulations against violators of the law.

The amendment is slated to be completed during the first half of 2013. The enforcement decree as well as related regulations are also scheduled to be prepared during the period. The government also plans to develop a standard model that can help airport operators establish the required autonomous security plans in a way that meet related laws and regulations. It will also serve as guidelines for applying different security standards depending on the characteristics of various airports.

2. Reinforcement of Security Measures for Air Cargo

Between 1995 and 2005, international air cargo traffic was increased at an annual average of 6.1% from 22.2 million tons to 37.7 million tons. The amount of international air cargo handled in Korea also kept growing with exception for 2009 when it dropped due to the global economic slowdown. The annual growth rates in Korea averaged 6.4% during the period.

With increase in the number of air cargo users, everybody can easily

know the structure and procedures of air cargo transportation. It is difficult to conduct thorough security checks on air cargo because of their diversity in volume, weight and characteristics. In this regard, air cargo screening has more security weaknesses than passenger screening. Aware of this, terrorists may seek to stage attacks against aircraft by using air cargo. They might believe that launching such attacks would be the most effective way in attracting global attention with the least possible cost. As a result ICAO and various other international organizations are continuously emphasizing the need to strengthen air cargo security.

In 2004, the government formulated "air cargo security standards" and put up a notice for the implementation of the Known Shipper Program, as a way to ensure speedy air cargo processing while improving the relevant security system. In 2005, the Enforcement Decree of the Aviation Safety and Security Act was amended to ensure that the Known Shippers would be designated by the government, not by the airlines. The government then revised the air cargo security standards through consultations with airlines and logistics companies so that they would better reflect market conditions. Implementation of the Known Shipper Program started in 2006.

At the second Korea-U.S. aviation security cooperation talks held in 2012 resulting in a joint statement that they would pursue a mutual air cargo security agreement. As follow-up measures, the two countries exchanged and examined relevant regulations and conducted on-site inspections. As a way to enhance international air cargo security, the United States was seeking to conduct agreements with various countries for mutually recognizing each other's air cargo security programs. Korea is aiming to formally enter the mutual air cargo security agreement with the United States by 2013. The agreement would cover cargo aircraft as well. Korea will likely be the first Asian country entering into such an agreement with the United States. Should its scope be extended to cover China and Southeast Asian countries where large amounts of cargo destined to Korea is processed, the mutual recognition accord would have positive impacts on facilitating cargo transportation by Korean national flag carriers. The government will continue to have

negotiations with the U.S. government on matters necessary for effective implementation of the agreement.

3. Reinforcement of Security aboard Aircraft

ICAO issued instructions that flight deck doors be reinforced by October 31, 2003 as a way to strengthen security aboard aircraft. In accordance with the instructions, Korean flag carriers installed bulletproof cockpit doors with double locking systems. The also began to carry devices designed to counter terrorist attacks or other acts of unlawful interference.

ICAO also recommended that a monitoring system be installed within the cockpit so that pilots can confirm or become aware of the occurrence of unlawful acts aboard the aircraft. It also recommended the establishment of cockpit entry/exit rules, involving the use of coded conversation among the crew. Complying with the recommendations, Korean airliners formulated cockpit entry/exit procedures and began to carry devices (stun guns, gas spray guns, etc.) that can be used by crew members designated as security agents in the event of emergencies. They also began to implement martial arts training and other relevant educational programs for flight attendants serving as security aboard aircraft.

Punitive provisions were further strengthened as well. The new provisions stipulate a prison term of up to 10 years for any person posing safety risks through acts of unlawful interference such as violence, intimidation, and threats. They also stipulate that those who pose safety risks by not following instructions issued by the captain or other crew members in their legitimate execution of duties shall be subject to a prison sentence of up to one year or a fine upwards of 10 million won.

In 2009, the government prepared the Standard Operational Guide to Aircraft Security that provided the criteria on measures air transport operators were required to take to ensure security and safety aboard aircraft. The guide included contents on flight deck security measures, response to

intimidation aboard aircraft, and aviation security training programs.

In 2013, more rigorous security measures are expected to be implemented. They include pre-takeoff and post-landing security checks and maintenance of locking systems designed to prevent illegal entry into flight attendants' rest areas aboard aircraft.

Section 3

Policy and Technology Development for the Future of Aviation Security

1. Future Aviation Security Policy

Future aviation safety policies will likely be based on the relatively new concept called the risk-based approach. This approach is about how to effectively use limited security resources. Implementing aviation security projects requires the use of resources such as personnel, capital and equipment. However, the nation has only a limited amount of these resources. So, it is very important to use them effectively by focusing on areas of weakness in terms of the capacity to respond to threats and risks. The risk-based approach is aimed at ensuring efficiency in the use of such resources. Instead of applying uniform measures, it applies schemes that can differ depending on the types of threats after classifying them into various categories through assessment of their levels of gravity. Applying this method requires implementation of risk assessment based on likelihood, vulnerability and consequences.

Sustainability of aviation security is an important policy direction being promoted by ICAO. "Sustainable aviation security" can be defined as the detection and prevention of, and response to and recovery from, acts or

attempted acts of unlawful interference with civil aviation, "utilizing means that can be sustained by the entity or entities responsible for the period of time required." Ensuring sustainable aviation security requires the application of risk-based security measures and outcomes-focused security policy. This underscores the importance of concentrating on results through the application of practical security measures, rather than placing emphasis on procedures. It is also important to apply the principle of mutual recognition of equivalence and one-stop security to minimize the re-application of security measures by securing departure-point security and to maximize efficiency by securing equivalence among states.

2. Future Aviation Security Technology

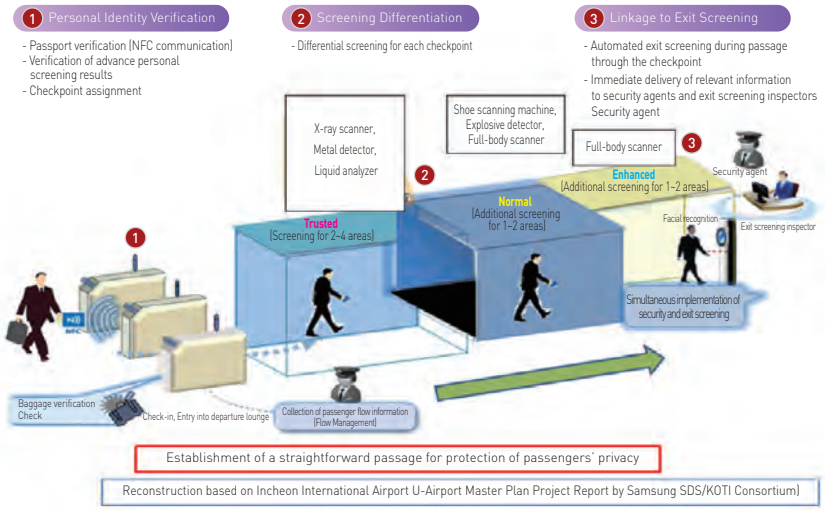
For Korea to become an advanced nation in the area of aviation security, it must pursue simultaneous development of relevant policies and technologies. Policies related to aviation security are expected to undergo a shift toward striking a balance between rigorous implementation of security measures and simplification of procedures. This will likely set the direction for development of aviation security technologies. In this section, this paper looks into a new security screening device being developed in Korea as a way to investigate the future concept of airport screening.

Screening Checkpoint of the Future

IATA has suggested a future checkpoint scheme (Figure 5.1) in order to enhance security, increase passenger convenience, and simplify departure procedures. The scheme envisions categorizing passengers by risk level through the use of advanced passenger information and profiling. Upon entry, passengers would be required to go to lanes assigned to them and undergo screening. The weakness of this scheme is that it could infringe on the privacy of passengers. In order to address the privacy problem Korea came up with

Figure 5.1 Concept of future IATA security checkpoint

Figure 5.2 Concept drawing of future security checkpoint being developed in Korea



the idea of installing a passage-type checkpoint (Figure 5.2). Under this system, passengers would use the same entrance and exit, but they would receive different types of security screening in accordance with their risk levels as they go along a passage equipped with stage-specific screen doors.

Future Screening Methods Using New Technologies

An increase in terrorist attacks using aircraft has led to calls for reinforcement of security screening for air cargo and passengers. Accordingly, various aviation-related international organizations have formulated or strengthened security measures. Implementation of these measures has become an important factor to be considered in airport performance assessment. Thus, security screening equipment of the future needs to be based on the idea of establishing an integrated security system. The devices should be developed by considering the prospects of ensuring swift and reliable screening procedures as well as flexibly coping with various human rights issues related to airport security checks. The security screening equipment of the future will feature various sensors and relevant technologies necessary for a 3-stage screening scheme based on categorization of risk levels (Figure 5.3). This system will be able to implement automated security screening based on automatic patterns for recognition of dangerous materials, thereby ensuring speedy and reliable security checks. In addition, image generators will be developed in order to implement security checks while guaranteeing the protection of human rights

Figure 5.3 Risk categorization scheme for future security screening equipment

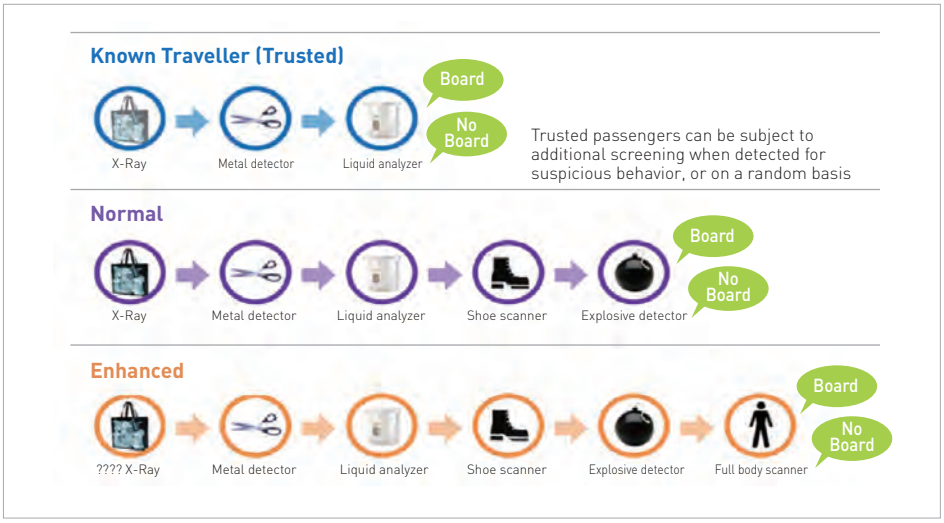
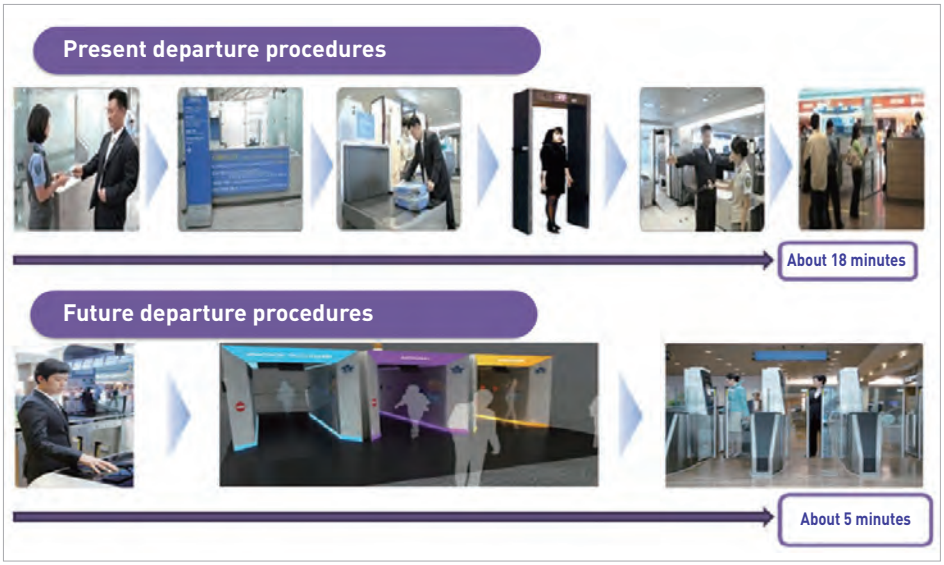


Figure 5.4 Present security screening procedures

and privacy to the maximum extent.

There will be many changes in the airport security screening system through the above-mentioned development of an innovative security checkpoint and a number of other security devices. Currently, airport security screening takes place through the following six stages: 1) personal identity verification and the assignment of security screening intensity, 2) baggage checks using X-ray scanners and other devices, 3) & 4) security checks using stationary and hand-held metal detectors, 5) extra scrutiny using shoe and full body scanners for high-risk passengers, and 6) inducement into the boarding area. The current system requires the use of personnel for deciphering and operating screening equipment at each stage consequently lowering the speed

Figure 5.5 Potential future simplified departure procedures



of screening.

The security checkpoint of the future will offer one-stop screening services based on the concept of integrated security checks (Figure 5.5). When the new system is in use security screenings will take significantly less time than it does now.

Section 4

Implications and Policy Directions

This section is dedicated to the examination of Korea's past and present as well as future policies and programs related to aviation safety and security. The past aviation safety policies were focused on laying the institutional basis and implementing on-site surveillance. In contrast, present policies are designed to ensure more substantial safety management through the use of analytical and autonomous approaches. In the future, emphasis is likely to be placed on expanding the current safety management program, operating risk forecast programs, and building a safety system for future flying devices such as unmanned aircraft and PAVs. Attaining such objectives will help the nation realize its goal of becoming a global power in terms of aviation safety. Aviation safety cannot be realized without aviation security. In this regard, efforts will also be exerted to develop further sophisticated aviation security equipment, train specialized personnel for security screening, and continuously improve various relevant laws and regulations.

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Chapter
06

Transition to Future Air Navigation Systems

Section 1

Limitations of the Present Air Navigation Policy and Facilities

1. Historical Background

The need for a new air navigation system began to be discussed in the 1980s when questions were raised about the capacity of the existing system to cope with the sharply rising global aviation traffic. In 1983, ICAO launched the Special Committee on Future Air Navigation System and formulated a plan to promote a new system. In 1991, the organization adopted a recommendation on the concept of CNS/ATM and related activities during the 10th Air Navigation Conference. Korea established a basic plan for CNS/ATM development in 1999. Four years later, it formulated a plan for mid to long-term development of air navigation facilities, and began implementing projects to expand and modernize the pertinent facilities. In 2005, the government devised the Comprehensive Plan for Building Future Air Navigation Safety Facilities. Two years later, it came up with a mid/long-term roadmap for the air navigation sector through research for the establishment of a mid to long-term transportation development plan. In 2008, a study was conducted for the preparation of a R&D roadmap for the future air navigation safety system. The next year, the Korea Transport Institute (KOTI)

made a basic plan for installing the nation's next generation navigation safety facilities based on an R&D roadmap in the CNS/ATM area. In 2010, KOTI carried out research on developing a navigation system as part of a project to support the green aviation industry. Based on the research, the institute set up a plan to establish CNS/ATM systems by air route and airport. On the basis of these activities, R&D and facility installation projects are actively underway in domestic CNS/ATM.

2. Problems with Existing Air Navigation Safety Facilities

A surge in air traffic cannot but cause air traffic congestion in various areas like flight paths and terminals. This problem cannot be addressed properly as long as the current navigation facilities are in use. Tacking the problem also requires looking into various related issues including the complexity of airspace management.

First, there is a problem with the accommodation capacity of the air traffic management system. Currently, most airplanes using airports in crowded airspaces worldwide are lacking in punctuality. Their operations are delayed in a repeated manner. This phenomenon is due mainly to the insufficient accommodation capacity of air traffic management systems and airports although some additional external factors may also be cited as contributing factors.

Second, the congestion problem causes increases in costs of airlines and passengers. Delayed flights mean financial damage to airlines in the form of additional fuel, wage and maintenance costs. Some economists assert that delay compensation should cover time wasted due to delays. Additionally, inefficiency related to air routes and flight courses leads to excessive fuel consumption and increased flight hours, which cause the accruement of additional expenses. Such a structure eventually has negative impacts on the national economy. Improper operation of an air transport system lowers a nation's productivity and competitiveness, undermining the national

economic structure.

Third, there is a problem with airspace structure. Improperly set and managed, the current structure makes it impossible to make effective use of airspace. Because of its dependence on just border-based artificial airspace division and vertical separation, the concept of area navigation (RNAV) is not being introduced in most areas.

Fourth, there is a problem with operational procedures. Ineffective operational procedures are undermining efforts to ensure speedy air traffic. The foremost reason is that the operational procedures are not keeping up with technological advancement. Ideally, 3D/4D flight information for aircraft should be provided dynamically, with involvement of a minimum number of air traffic control agencies. In reality, complicated air traffic control procedures are standing in the way of progress blocking an ideal situation. Another negative factor is sufficient compatibility is not maintained between aircraft and ground operating elements.

The following air navigation problems can be cited for oceanic airspace. In oceanic regions the current communication, navigation, surveillance and traffic control systems can be operated only within line-of-sight distances. This poses a risk to the safe operation of aircraft and causes difficulty in facilitating air traffic management, eventually exercising negative effects on flight safety.

The most prominent problem with continental airspace areas is the numerous places where it is difficult to install air communication, navigation and surveillance/traffic control facilities. Thus the lack of facilities makes it difficult to ensure the safety of aircraft operations. It is difficult to find proper places to install equipments and facilities needed for air safety. Installing equipments in such areas also requires the resolution of various technological and financial problems. Even if such equipments were installed, problems could occur in ensuring proper operation. For example, a lot of additional expenses should be spent in order to minimize the effects of environmental factors such as humidity, temperature, and floods. Further, should such devices be installed in remote areas, there would likely be problems related

to working conditions of repair and maintenance agents. It would also be difficult to transport repair technicians to such places in the event of a malfunction of equipment.

3. Limitations of the Present Navigation Safety Facilities

The existing navigation safety facilities have their limitations due to their reliance on radio signals (VHF, HF, etc.) for communication. Because of the characteristics of radio waves, ensuring accuracy in communication requires a lot of effort and it is difficult to find proper locations. Korea, which has many mountainous areas, finds it particularly difficult to build such facilities at proper locations because of radio wave interference. Another weakness of the current system is the range of radio waves restricted to line of sight. This makes it difficult to develop effective routes because of the need to install facilities at certain locations. Furthermore, due to technological limitations of the current surveillance system relying on radar, it becomes difficult to conduct surveillance on planes flying at low altitudes or in mountainous areas.

Such capacity limitations of communication facilities could cause difficulty or inefficiency in information exchange. Voice communication between pilots and air traffic controllers could lead to communication errors along with difficulty to convey large amount of information. In addition, the current system causes inefficiency in the use of frequencies due to frequency allocation for various needs as well as frequency occupation during communication between aircraft and ground facilities. In particular, it is impossible to implement simultaneous communication with multiple aircrafts, making it difficult to ensure smooth air traffic flow during peak hours within the Seoul Approach Control sector.

Sometimes, information systems are not connected with each other. Different connection methods used by the systems are causing technological and economic difficulties in ensuring system integration for speedy delivery

and sharing of information.

The limited capacity of the current air traffic control system has negative impacts on the overall process of air traffic management. The insufficient processing capacity of the control system as well as the lack of technology to ensure flexible traffic management are causing limitations in increasing airspace capacity and future air traffic accommodation capacity. Additionally, due to the lack of interoperability between traffic control agencies, the information delivery system relies on non-automated methods, causing difficulty in ensuring smooth air traffic management.

Section 2

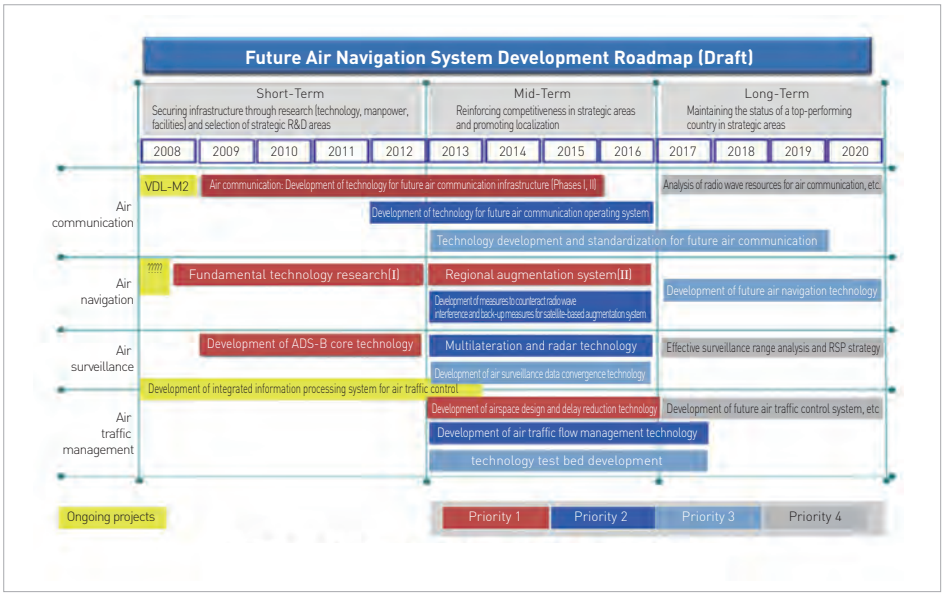
Formulation of Future Air Navigation System Development Plans

1. R&D for Future Air Navigation System

Having built its air navigation system with mostly imported equipments, Korea originally focused on ensuring its efficient operation and management. However, questions were raised about the desirability of continuing to depend on potentially expensive foreign products. The dependence on foreign products also made it difficult to ensure expeditious repair and maintenance. To address this problem, the government and relevant research institutes started to pay attention to the prospects of developing local technology for the future air navigation system (CNS/ATM). Yet, due to budgetary restrictions, just academically oriented studies were implemented in an uncoordinated manner, without launching systematic and full-fledged research projects.

In 2005, based on the Global Air Navigation Plan (ICAO Doc 9750), the Ministry of Land, Transport and Maritime Affairs formulated a comprehensive plan for future air navigation systems and a basic development plan for the national satellite navigation system. These plans were designed to establish future air navigation systems at domestic airports in compliance

Figure 6.1 Roadmap for developing future air navigation system



with ICAO-recommended international standards as well as to help ensure the development of Korea as an economic and logistics power in Northeast Asia. In 2009, the ministry revised the plans to cope with changes that took place in global air navigation. R&D on future air navigation systems began to be promoted in earnest as part of the aviation advancement project launched by the ministry. In 2008, a roadmap was formulated for laying the basis to ensure systematic R&D for the future air navigation system. Figure 6.1 illustrates the roadmap for developing future air navigation system in relation to the ministry's advancement project.

The roadmap presented the following four objectives for the R&D project:

- To increase aviation safety by three times through efficient and safe operation of airspace and airports
- To double capacity to accommodate air traffic which is continuously on the rise
- To save fuel by 10% through user-oriented safe and economic flight

operations

- To contribute to low-carbon green growth by reducing carbon emissions by 10% through establishment of effective air navigation systems

Efforts are underway to systematically connect relevant domestic organizations in order to ensure smooth implementation of the future navigation system project. The Ministry of Land, Infrastructure and Transport is responsible for formulating basic plans and securing necessary funds. Future navigation facilities are slated to be developed and built by the facility operators (airport corporations) and the users (airlines) with cooperation of pertinent industries and the specialized CNS/ATM certification agency. This agency should be selected from among public research institutes with relevant technological prowess and the capacity to implement the project in a fair manner. Building future navigation facilities requires specialized knowledge and experience. Agencies involved should also participate in a standardization process involving international organizations. The ministry should appoint specialized agencies for the project by considering these aspects, thus making certain that it can be performed in a stable and continuous manner.

The roadmap includes the following strategies:

- Short-term strategy (2011-2015): formulation of standard technology and verification measures for domestic application of CNS/ATM, establishment of pilot airport programs as well as verification, technological evaluation, operation procedures, and inducement of active participation of airlines and other related organizations in the project
- Mid-term strategy (2016-2020): installation of future navigation safety facilities at the 15 domestic airports, improvement of airspace structure and development of flight procedures in preparation for full-fledged operation of the future navigation system, establishing the legal framework for the installation and use of future electronic equipment on aircraft, promotion of technological cooperation, and joint evaluation with neighboring countries

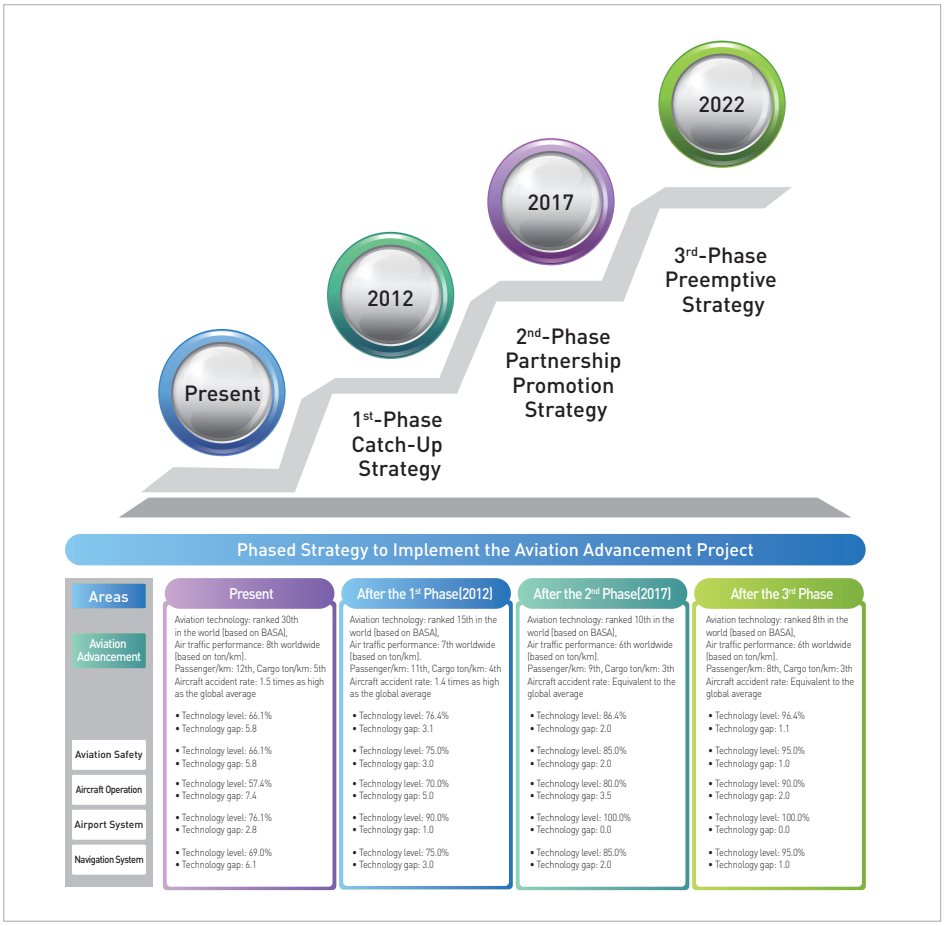
- Long-term strategy (2021-2025): building a perfected system for transition to CNS/ATM, establishing the use of electronic equipment for the system aboard aircraft, and removal of old facilities

2. Aviation Advancement Project

Korea is a global aviation power. The aviation sector is making a significant contribution to the national economy and helping to increase national prestige overseas. However, the aviation sector lags far behind construction and rail sectors in terms of R&D investment. Against this backdrop, the government is implementing the aviation advancement project designed to facilitate development of aviation technology and improve the quality of services. Through the project, Korea intends to join the ranks of the world's 10 most advanced nations in terms of aviation technology. The project has the following objectives: ensuring the advancement of the aviation industry, expanding the basis for exports through development of aircraft on a phased basis, developing future airport operation technology through the application of state-of-the-art IT, and developing a future satellite navigation system for aircraft. A total of 148.9 billion won was injected in the project up to 2011. The amount breaks down to 19.4 billion won in 2007, 16.87 billion won in 2008, 29.5 billion won in 2009, 38 billion won in 2010, and 45 billion won in 2011.

Korea is a latecomer in the field of aviation technology. To catch up with advanced countries, it needs to devise a differentiated technology. Of the ICAO member states, Korea ranked eighth in terms of air traffic volume (based on ton/km) in 2006. Yet, its aviation accident costs were 1.5 times as high as the global average. In terms of the percentage of GDP per km, Korea's aviation accident costs were 10 times higher as those of the United States and Australia. In this category, Korea was in the lower middle range among ICAO members. With respect to technology needed for aviation advancement, Korea's overall level is at 66.4%, compared with the top-performing countries; United States and Europe. To put this another way, Korea is lagging behind top-rate

Figure 6.2 Phased aviation advancement implementation strategy



countries by 5.8 years in this category. Analysis suggests that Korea should pursue the following methods to secure the technology needed for its aviation advancement project: imports (7.3%), international collaboration (58.0%) and unilateral development (34.8%) indicating for Korea to secure its desired technology through international cooperation. Thus, the nation is pursuing a three-phase implementation strategy (Figure 6.2): catch up with top-performing countries by securing core capabilities based on competition and cooperation, building partnership with advanced countries, and secure a leading status based on comparative advantage obtained through a selection and concentration approach and preemptive tactics.

3. Performance-Based Navigation

At the 36th ICAO General Assembly held in September 2007, ICAO urged all states to implement routes and airport procedures in accordance with the ICAO performance-based navigation (PBN) criteria. Resolutions include the following:

- States and planning and implementation regional groups (PIRGs) complete a PBN implementation plan by 2009 to achieve the following matters:
  1) Implementation of RNAV and RNP[1] operations for en route and terminal areas according to established timelines and intermediate milestones
  2) Implementation of approach procedures with vertical guidance (APV)[2] for all instrument runway ends, either as the primary approach or as a back-up for precision approaches by 2016 (with intermediate milestones as follows: 30% by 2010 and 70% by 2014)
- ICAO develop a coordinated action plan to assist the contracting states in the implementation of PBN and to ensure development and/or maintenance of globally harmonized Standards and Recommended Practices (SARP), Procedures for Air Navigation Services (PANS), and guidance material including a global harmonized safety assessment methodology
- Contracting states include in their PBN implementation plan provisions for implementation of approach procedures with vertical guidance (APV) to all runway ends serving aircraft with a maximum certificated take-off mass of 5,700 kg or more, according to established timelines and intermediate milestones
- The Council provides a progress report on PBN implementation to the

1) Required navigation performance (RNP): surveillance and warning systems are needed.
2) Approach procedure with vertical guidance (APV): quasi precision approach procedure that allows aircraft to land by descending at a fixed angle using a barometric altimeter and satellite signals without relying on glide path signals.

next general session of the Assembly and PIRG include in their work program the implementation status of PBN by states according to defined implementation plans and report to ICAO any deficiencies that may occur

By considering aviation characteristics and CNS/ATM capacity of the Asia-Pacific Region, ICAO applied the RNAV and RNP concepts after classifying air routes into three categories: ocean, remote continental, and continental. To facilitate the transitional period, the organization determined to maintain conventional approach procedures and conventional navigation aids for non-equipped aircraft.

ICAO presented the following short and mid-term targets:

- Short-term implementation targets:
  - RNP APCH/APV for 30% of airports by 2010 and 50% by 2012, priority should be given to airports with operational benefits
  - RNAV 1 Standard Instrument Departure and Standard Arrival Routes (SID/STAR) for 50% of airports by 2010 and 75% by 2012, priority should be given to airports with RNP approach (RNP APCH) and operational benefits
  - RNAV/RNP air routes under implementation to be redefined as per PBN navigation specification by 2012
  - Designation and implementation of additional RNAV/RNP routes

Table 6.1 Asia-Pacific region short-term (2008-2012) PBN implementation targets

Airspace	Navigation specification (preferred)	Navigation specification (acceptable)
Ocean routes	RNP 4	RNAV 10
Remote continental routes	RNP 4	RNAV 10
Continental routes	RNAV 2, RNAV 5	
STAR	RNAV 1 (radar) Basic RNP 1 (non-radar)	
SID	RNAV 1 (radar) Basic RNP 1 (non-radar)	
Approach procedures	RNP APCH/APV RNP AR APCH	

- Mid-term implementation targets:
  - RNP APCH/APV in 100% of instrument runways by 2016
  - RNAV 1 or RNP 1 SID/STAR for 100% of international airports by 2016
  - RNAV 1 or RNP 1 for 70% of domestic airports where there are operational benefits by 2016
  - Implementation of additional RNAV/RNP routes

Table 6.2 Asia-Pacific region mid-term (2013-2016) PBN implementation targets

Airspace	Navigation specification (preferred)	Navigation specification (acceptable)
Ocean routes	RNP 2	RNP 4, RNAV 10
Remote continental routes	RNP 2	RNAV 2, RNP 4, RNAV 10
Continental Routes	RNAV 1 , RNP 2	RNAV 2, RNAV 5
STAR	RNAV 1 expansion or RNP 1 application RNAV 1 or RNP 1 flight approval to be required within TMA with heavy traffic	
SID	RNAV 1 expansion or RNP 1 application RNAV 1 or RNP 1 flight approval to be required within TMA with heavy traffic	
Approach procedures	RNP APCH & APV expansion RNP AR APCH expanded application in areas where there are operational benefits Introduction of landing performance using GNSS & GNSS Augmentations	

In accordance with the ICAO resolution, Korea prepared a PBN roadmap in 2009. Since 2010, it has been replacing all the flight, departure/arrival and instrument approach procedures with PBN procedures. It is planning to introduce the PBN system to all the flight routes and airports within the Incheon FIR up to 2016, thereby promoting aviation safety and creating an environment for economic flight operations.

4. Basic Plan for Building Future Air Navigation Systems

With aviation congestion worsening due to limited airspace resources and

a rapid growth in air traffic, the global aviation community is facing the need to improve the existing ATM system by departing from its reliance on conventional technology that have been used for the past 40 years in the air transport industry. In its 10th Air Navigation Conference, ICAO resolved to adopt satellite-based CNS/ATM as the future navigation system to cope with growing demand for air transport services in the 21st century. Construction of the CNS/ATM system is expected to enable real-time supply of aviation information, precise surveillance of flight conditions, establishment of accurate flight procedures, and effective air traffic management, thereby enhancing the safety and profitability of flight operations. Thus, a growing number of countries are showing positive responses to the global CNS/ATM project.

Keeping up with the international trend, Korea formulated a comprehensive development plan for future navigation safety facilities and a basic plan for national satellite-based navigation system in 2005. Since then, there have been changes in the relevant technology development environment domestically and abroad. The ICAO project to build a global air navigation system by 2010 has been delayed by five years; the organization established a new project plan (Global Air Navigation Plan 3rd edition) in 2007. Korea has thus revised its existing plans by establishing the Basic Plan for Building Future Air Navigation Systems.

The plan envisioned "attaining a leap forward to become a Northeast Asian aviation hub through reinforcement of safety and economic prospects of air transportation." Aiming to "ensure efficiency and safety in the operation of airspace and airports," the plan presented the following tasks:

- Conform with international technological and environmental requirements as a member state of ICAO
- Facilitate the accommodation of continuously increasing air traffic
- Create user-oriented conditions that can ensure safer and more economical flights
- Secure efficient air transport surveillance systems and operating procedures

- Improve the efficiency and safety of airspace management through productivity enhancement
- Contribute to low-carbon green growth through the establishment of effective navigation systems

Implementation Strategy and Phased Implementation Plans for Air Communication Sector

- Giving priority to the development of VHF Data Link (VDL), a basic means of future aviation communication
  ※ Development of VDL technology for aviation (2005-2009)
- Pursuing a strategy for transition to a data link communication for aircraft, while maintaining the current facilities until the new system stabilizes
- Preparing a VHF data link communication network system for domestic airspace areas where VHF communication is possible, while studying other measures such as Aeronautical Mobile Satellite Service (AMSS) for other areas
- Maintaining HF radio facilities for long-haul air transport communication

Table 6.3 Building future air communication facilities

Present systems	Future systems		Period
	Envisioned systems	Purpose	
AFTN	Comprehensive aeronautical communication network (ATN/AMHS)	Integrated information communication network involving control centers, airlines and aircraft of various countries	Short and mid-term
Direct call (voice)	Data communication network between traffic control centers (AIDC)	Exchange of traffic control information through data communication between neighboring air traffic control centers	Short and mid-term
Wireless call (voice)	Digital pre-departure clearance (D-PDC), digital airport terminal information system (D-ATIS), Mode S communication equipment	Upgrading the current voice communication method to a data link communication scheme * Mode 1 class → Mode 2 class (improvement)	Short and mid-term
VHF radio (voice)	Air mobile data communication facilities (VDL)	Aircraft control information exchanged between controllers and pilots through data communication	Mid-term and mid to long-term
HF radio (voice)	Air mobile satellite communication facilities (AMS(R)S), HFDL, etc.	Exchange of aeronautical information with remote continental or oceanic regions through data communication	Shelved

- Giving short-term priority to laying the groundwork for an integrated data communication system through establishment of ATN/AMHS
  ※ Joint development of ATN/AMHS by Korea, China and Japan (2008-2010)
- Promoting air-ground communication connections involving Mode-S, AMS(R)S and Controller-Pilot Data-Link Communications (CPDLC) in accordance with ICAO policy direction and international trends

Implementation Strategy and Phased Implementation Plans for Air Navigation Sector

Given the special situation of Incheon FIR, Korea has established a plan to make the switch to the satellite navigation system by considering the extent of progress the United States, Japan and China have made in installing future navigation facilities.

Until the establishment of the Global Navigation Satellite System (GNSS), it is necessary to closely pay attention to the trends concerning the shift to the satellite navigation system while improving and installing conventional facilities (VOR, DME, ILS, etc.). Establishing GNSS requires the implementation of supplementary measures such as installation of GPS or Functional Movement Systems (FMS) on aircraft and operation of the relevant monitoring system, which has been used at Jeju Airport on a pilot basis.

It is also necessary to conduct a pilot implementation of the ground-based augmentation system (GBAS) at Ulsan, Gimhae and Jeju airports, which rank mid-range in terms of congestion. It would be desirable to expand the system to cover all airports if the results of the pilot implementation are positive. GBAS is easy to understand in terms of procedural composition and specific standards as well as technological aspects. In addition, it can be used without being affected much by system changes in neighboring airspace and countries.

Thus, priority should be placed on developing GBAS CAT-I certification technology so that it can be used in developing and building airport approach

and takeoff infrastructure for domestic airports.

※ Development of GBAS CAT-I certification technology (2009-2014)

In the short term, the new air navigation infrastructure strategy focuses on building GBAS CAT-I, thus securing the basis for new approach and takeoff/landing systems at domestic airports. GBAS is expected to help address traffic congestion at terminals, insufficient accommodation capacity of airports, and flight delays.

The current GBAS can support only the accuracy of CAT-I precision approach. However, with GPS modernization or the addition of the GNSS satellite system in the future, it will be able to replace ILS as it can provide CAT-II and CAT-III precision services as well.

As for satellite-based augmentation system (SBAS), it would be desirable for Korea to seek ways to use relevant services through connections to WAAS (U.S.), MSAS (Japan) and EGNOS (Europe), as long as significant changes do not occur in the current situation. For this, six reference stations and one ground station need to be established domestically. At the same time, the nation should carry out long-term research on building its own SBAS.

Satellite-based navigation systems being developed globally are based on GPS. Thus, it is necessary to build a regional augmentation GPS system as well as promote the development of avionics. Korea also needs to study the

Table 6.4 Building future air navigation facilities

Present systems	Future systems		Period
	Envisioned systems	Purpose	
VOR, DME	Maintenance of global navigation satellite system monitoring (GNSS monitoring)	Check the operational conditions of GPS, GLONAS, GALILEO or satellite-based augmentation system through monitoring of their signals	Short-term
ILS, VOR, DME	Ground-based augmentation system (GBAS)	Pilot operation of GBAS CAT-I at airports and expansion	Short and mid-term
		Aircraft can implement precision approach and takeoff/landing through multiple paths by using CAT-II/III-class GBAS	Mid and long-term
VOR, DME	Satellite-based augmentation system (SBAS)	Aircraft can implement precision flight on routes or over airports using SBAS	Mid and long-term (priority given to reference station establishment)

prospects of using convergence technology such as Russia's GLONASS and the European Union's Galileo.

International standard equipment for ABAS has not yet been fully developed for its practical use. However, it would be desirable to be prepared for the possibility of ICAO calling for mandatory installation of ABAS equipment aboard aircraft.

Implementation Strategy and Phased Execution Plans for Surveillance and Air Traffic Control Sector

- Giving priority to development of ADS-B and MLAT technology, essential elements for surveillance and air traffic control, establishment of infrastructure for domestic airports and air routes
  ※ Development of ADS-B technology for air surveillance (2009-2014)
- Implementing a new ADS-B system for surveillance at airports and routes on a pilot basis, and improving the air traffic management system, thus laying the basis for a new navigational support structure
- Basically pursing transition to the ADS-B system for data link-based air surveillance, while maintaining for some time the existing radar facilities that can cover nearly all of the nation's airspace, thus causing no problem to the use of aircraft
- Implementing a pilot ADS-B (1090ES class) program at Jeju Airport and promoting gradual development of 1090ES-class, UAT-class or VDL Mode 4-class system, depending on the domestic R&D conditions and international trends. The ADS-B system could be expanded to cover air traffic centers, approach control stations, and air traffic control towers.
- It is necessary to closely watch Secondary Surveillance Radar (SSR) Mode-S, which is not widely used although it is in operation in some parts of Europe. In the Asia-Pacific Region, Japan and China are gradually improving SSR Mode-S. Thus, it would be desirable for Korea to try to include the Mode-S function when improving some of its SSRs.
- In domestic areas where flight procedures are complicated because of

the difficulty using radar for aircraft detection or obstacles, installation of SSRs should be determined after carefully assessing the effects of the combined use of the existing radar and ADS-B or MLAT

- Maintaining of primary surveillance radar for monitoring of flying devices not equipped with transponders, depending on airspace conditions
- Improving existing facilities of the air traffic management system in a way that can facilitate airplane flights within domestic airspace, while trying to ensure fuel saving and minimization of aircraft engine emissions through use of direct flight routes and reduction in the duration of flights over terminal areas. It is also necessary to consider introducing the air traffic flow management system.
- Building the advanced surface movement guidance and control system (A-SMGCS) at international airports, while exerting efforts to improve its surveillance functions by using ADS-B in addition to the airport surface detection equipment (ASDE), intensify control functions designed to prevent runway intrusions, manage the aircraft departure/arrival schedule in association with the flight data processing system, and ensure safe aircraft guidance even in low-visibility conditions in association with the individual air light control and monitoring system
- ATMS, A-SMGCS and CDTI are ultimately linked to the electronic aviation information management system (eAIM), using the database that provides information on airports, routes, topography and obstacles, weather conditions, maps and charts, services and procedures through data models like Aeronautical Information Exchange Model (AIXM), Aerodrome Mapping Exchange Model (AMXM), and Weather Information Exchange Model (WXXM)
- eAIM facilitates the use of the digital notice to airmen (xNOTAM), flight planning management, ePIB, eAIP, weather data management, and work flow management

Table 6.5 Future air surveillance and traffic control facilities

Present systems	Future systems		Period
	Envisioned systems	Purpose	
Radar (PSR, SSR, SMR or ASDE, PAR)	Automatic dependent surveillance-broadcast system (ADS-B/TIS-B/FIS-B)	Through data link, an aircraft conveys information on location, registration code, speed and altitude to nearby planes or air traffic control center. The control center manages flight safety based on information it received from the aircraft.	Short and mid-term
	Multilateration	An aircraft conducts surveillance on other planes at airports or during flights	Short and mid-term
Surface movement guidance and control system (SMGCS)	Advanced surface movement guidance and control system (A-SMGCS)	Reducing air traffic volumes through minimization of runway occupancy time at airports	Short and mid-term
Air traffic control (ATC) system	Air traffic flow management (ATFM) system	Adjusting traffic density by sector in areas with high air traffic density	Short and mid-term
	Air traffic management system (ATMS)	Making the switch in concept from aircraft control to aircraft management, in association with the air information management system (eAIM)	Mid and long-term

5. Developing an Air Navigation System for Green Aviation Industry

The future air navigation system (CNS/ATM) can be defined as a structure for continuous air traffic management based on the application of communication, navigation, and surveillance schemes. In order to cope with rapidly growing demand for air traffic services, ICAO adopted CNS/ATM as the future air navigation system at the 10th ICAO Air Navigation Conference held in September 1991.

In Korea, pertinent government organizations assisted by the academic community and research institutes have formulated plans for the establishment of CNS/ATM system. In accordance with the plans, some R&D projects are underway. However, it is necessary to revise yearly roadmaps in order to accommodate changes in the air transport environment and to implement additional R&D projects aimed at ensuring an air navigation system that can enable the operation of eco-friendly aircraft.

4-Dimensional Trajectory-Based Air Navigation System

In order to promote the low-carbon green aviation industry, Korea needs to build an operational environment for 4-dimensional Trajectory-based (4DT) navigation system based on a progressive new concept designed to accommodate a larger number of aircrafts and reduce flight distance by using limited airspace and airport facilities. Establishing the 4DT navigation system requires application of the results of the ongoing or planned R&D projects on essential elements such as ADS-B, DataComm, PBN (RNP, RNAV), D-AIM (e-AIM) and GBAS. In addition, Korea needs to secure core technology and minimize the risks of failure through collaborative research with advanced countries that have substancial experience and technological knowhow in relevant areas. It is also necessary to step up efforts to secure essential technology and expand the relevant markets by establishing a cooperative system among industries, research institutes, universities, and the government.

Air Traffic Flow Management System

Air traffic control agencies are responsible for effectively implementing air traffic flow management systems. On behalf of the aircraft operators, they should try to ensure smooth traffic flow and prevent traffic volume from exceeding the accommodation capacity. Demand for air traffic services is forecasted to continuously rise (5.5% domestically). Meeting this demand requires an increase in accommodation capacity. However, under current conditions airspace congestion is expected to be aggravated. Measures need to be taken expeditiously to address this problem.

Korea needs to develop air traffic flow management (AFTM) technology as a way to tackle the airspace congestion problem. Particular emphasis should be placed on developing core algorithms and equipment for establishing AFTM and securing operational technology.

Multilateration System

Continuously growing air traffic and the appearance of new-concept aircraft such as PAV and UAV are causing increased risks of mid-air collisions. Preventing such collisions requires the development of a three dimensional and reliable precision surveillance system. To meet this requirement, Korea is promoting a plan to develop a multilateration (MLAT) system that is less expensive and more reliable than the current radar system. The government is pursuing the project while targeting international as well as domestic markets.

The utmost emphasis is placed on meeting the growing demand for air traffic services as well as ensuring flight safety.

Multi-Purpose Wide Area Augmentation System

Air traffic is increasing continuously (annual average of 5.5% in Korea) with aircraft operations forecasted to rise 70% by 2020 compared with the current level in 2010. This outlook indicates the need to improve performance of the satellite-based air navigation system, which is the core element of PBN support facilities, in order to address congestion and cope with growth in demand. This project includes a program to provide calibration information that can be used for various purposes. It is expected to help realize an efficient and stable future national transport system that covers not only the air navigation sector but areas involving automobiles and ships. It is also aimed at providing better location-based information services.

The development of the multi-purpose wide area augmentation system (MWAAS) is aimed at providing high-precision and highly reliable air navigation augmentation services to users of the satellite-based navigation system for ground, maritime, and air transportation.

Expected Effects

Through the operation of 4DT, Korea could increase accommodation capacity of domestic airspace and airports, improve operational efficiency,

and reduce aircraft engine emissions.

- It will be used for improving efficiency in air traffic management, ensuring optimal interplane distances, and facilitating departure/arrival and runway usage procedures in ultra high density areas. It will also help reduce aircraft emissions by shortening flight paths.

  The system can help ensure balanced distribution of air traffic flow and prevent extended flight duration, thereby securing flight safety and reducing economic losses.
- By adjusting takeoff times, it can help maintain optimum traffic volumes within the air traffic controllers' processing capacity thus minimizing unnecessary flight duration, preventing mid-air collisions, and improving aviation safety
- It can increase the processing capacity of the air traffic control agencies if effectively used to ensure the maximum use of the domestic airspace through cooperation between the private sector and the military

  Through development of the MLAT system, Korea could secure core technology for precision surveillance of aircrafts and airport ground vehicles, significantly increasing safety and reliability in airport operations.
- Surveillance in blind zones, detection of low-altitude flights, and drastic reduction of operating costs through replacement of high-priced decrepit radar (installation costs less than half of the expenses for radar, operating cost at 15%)
- Reliable navigational support for high-density airspace operation in preparation for the appearance of new-concept aircrafts such as PAV and UAV

  By replacing the conventional navigation facilities such as ILS, VOR and DME with the MWAAS-based next generation navigation system, the nation can satisfy growing demand for air traffic services and ensure flight safety.
- Realizing the idea of building a green navigation system by cutting flight time and fuel consumption while meeting ICAO-recommended

future air navigation system standards

- The system covers the entire Korean Peninsula, thus enhancing the prospects of cost saving in the event of inter-Korean unification. It can also help safeguard the nation's sovereignty in terms of navigational service and ensure the status as a leading nation in this category through development of SBAS CAT-I technology.

By introducing the future air navigation system in accordance with ICAO recommendations, Korea can play a leading role in establishing relevant international technology standards. Eventually, it can secure the same status as a top-performing nation in international aviation. This will result in increased national prestige, expansion of CNS/ATM-related markets, employment opportunities, and creation of a new domestic growth driver.

Section 3

Formulation of Plans on Future Air Traffic Management System

Countries with a long tradition of aviation are taking action to ensure advanced air traffic management (ATM). ICAO is providing multi-faceted assistance for the establishment of safer, more effective and sustainable ATM. Based on this support, each region has been exerting efforts to establish ATM. As typical examples, Next Generation Air Transportation System (NextGen) of the United States and Single European Sky ATM Research (SESAR) of the European Union can be cited. Such ATM modernization plans have been steadily implemented since they were formulated over a decade ago.

Keeping up with such international trends, Korea announced the first Basic Plan for Aviation Policy in 2009 and the Comprehensive Plan for Mid to Long-Term Aviation Safety in the next year. In 2011, it devised the 4th Comprehensive Plan for Mid to Long-Term Airport Development, which represented its endeavor to play a leading role internationally in the area of airport planning and operation.

Korea has formulated various roadmaps for future air navigation systems in preparation for the operation of future ATM. In 2009, the government announced a basic plan for future air navigation systems, presenting programs for introduction of state-of-the-art navigation technology and

R&D for ground equipment and aviation electronic devices. In addition, it formulated a PBN roadmap and an AIS-AIM implementation roadmap in the same year. The next year, the government released a roadmap for the implementation of ICAO's new navigation plan. These roadmaps provide policy guidelines required for individual sectors. However, they left much to be desired in providing a vision for making plans and carrying out individual projects based on consideration of the whole system.

To address the problem, the Ministry of Land, Transport and Maritime Affairs in 2011 began to implement a plan for the establishment of the nation's future ATM system. The plan was named the National ATM Reformation and Enhancement (NARAE means "wing" in Korean). The ministry then formed a NARAE task force to devise the nation's first master plan for the future ATM system. Vision 2025 of NARAE presents the following objectives:

- Strategic and cooperative air traffic management
- Effective and flexible airspace
- Timely supply of important information
- Integrative safety management
- Flexible and performance-oriented operation
- User-oriented implementation

NARAE is designed to take an integrative and cooperative approach toward the ATM system and aviation policies which have so far been devised and operated on an individual program basis. It is based on ICAO guidelines for the establishment of an integrative and performance-oriented aviation structure and will continue to accommodate such guidelines.

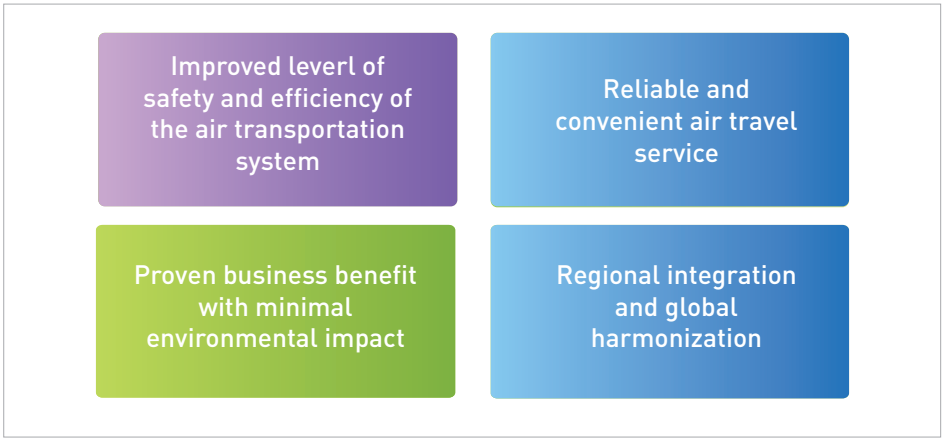
The NARAE task force was formed in November 2011. It is comprised of various members from the academic community and private aviation organizations. It is responsible for formulating the Master Plan based on ICAO guidelines, which emphasize the need for global integration and performance-based system and regional plans of NextGen and SESAR.

NARAE will ensure further development of satellite-based location

confirmation technology, making it possible to obtain more accurate information on aircraft location and conditions in the sky and on the ground. If ATM decisions are made in a cooperative manner throughout all flight procedures, including takeoff and landing, various stakeholders' requests and their targets could be accommodated in a more comprehensive manner. The data-rich environment based on the high-speed digital network makes it possible to ensure timely flow and sharing of information, facilitating the process of users making major decisions. The improved capacity to recognize the conditions in the sky and on the ground will lead to efficient operations of individual aircraft or the entire aviation system. Transition from voice-based communication to digital data-oriented communication will lay the groundwork for ensuring more extensive data collection and the effective distribution and sharing of information.

The new system will help maximize the benefits of airlines while boosting convenience for travelers. Supply of reliable departure/arrival information and the use of flexible flying paths can increase the operational efficiency of aviation systems, eventually making it possible to provide users with various convenient services. An effective system for air traffic flow management will be established through the use of future ATM functions that can help ensure a balance between air traffic demand and accommodation capacity of the

Figure 6.3 NARAE long-term vision



aviation system. Under the future ATM environment, the aviation sector will become more environmentally friendly in terms of fuel selection, aircraft design and the operation of aviation systems.

Realization of the national ATM plan through NARAE will bring a variety of changes to the overall air transport system:

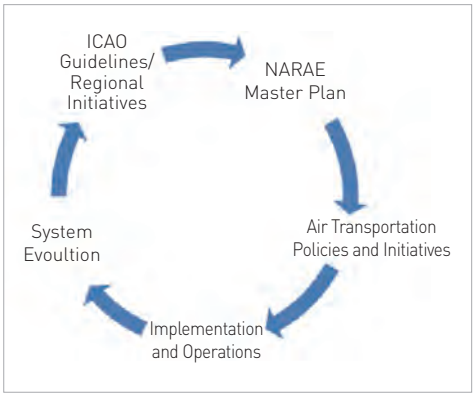
- In managing air traffic flow, a strategic cooperative system will replace the short-term tactical approach highly depending on human resources
- Effective and flexible airspace management will make it possible to use limited airspace more extensively, thus helping to meet air traffic demand in both the private and military sector
- To ensure timely distribution of correct information, high-level techniques will be introduced for the management of various data such as flight plans, weather forecast, and aviation and surveillance information
- Decisions on R&D or introduction of major technical enablers will be made by considering the entire system's accommodation capacity and expected changes rather than the prospects of drawing investments into specific technology
- Integrated safety management system will be in operation year-round for system users and information providers
- The future ATM system is expected to provide an appropriate operational environment by considering the capabilities and preference of users. System users will make investments based on such an environment.
- ATM services will be provided in a way that best suits the user's capabilities. Such a flexible ATM environment will benefit system users to a considerable extent.
- Air passenger convenience will be enhanced through the creation of a comfortable and convenience travel environment, reduction in obstacles, and advances in technological and operational elements. The new system will also benefit the general public as it will reduce aircraft noise and carbon dioxide emissions

In addition to the United States and Europe, various other countries are implementing plans to establish the future ATM system. Korea is one of these countries. Japan, China and Singapore are also preparing master plans for the system. In order to ensure successful implementation of NARAE, Korea needs to promote close cooperation with these countries.

1. ATM Basic Plans and Implementation

The NARAE master plan should change over time. Its operational concept and functions need to be adjusted as the national ATM system is in transition. When revising the plan, the updated ICAO guidelines as well as NextGen, SESAR and other regional implementation plans must be taken into account. Therefore, the NARAE Master Plan's life cycle begins with a system performance evaluation and determination of direction for R&D and implementation projects. Air Navigation Service Provider (ANSP) is responsible for developing action programs needed for satisfying NARAE performance targets as well as continuously monitoring the progress of NARAE. The entire revision process occurs periodically because of the need to adjust short-term targets and correctly identify the changes in the global ATM environment.

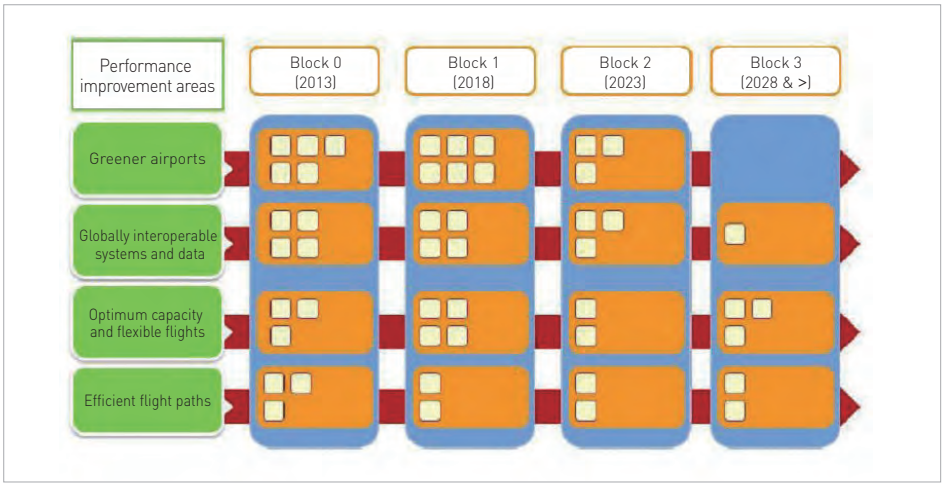
Figure 6.4 NARAE Master Plan's life cycle



2. Aviation System Block Upgrade

NARAE accommodates ICAO's Aviation System Block Upgrade (ASBU)

Figure 6.5 ICAO ASBU



structure as an implementation plan. ASBU consists of the four elements: module, block, thread, and performance improvement areas. According to the ICAO ASBU working paper, a module is a (performance) development package. A thread means a series of modules across consecutive blocks, representing coherent transition from basic to advanced functions. A block consists of modules that facilitate major improvements and provide relevant benefits. ICAO classifies performance improvement areas into the following four categories: greener airports, globally interoperable systems and data–through globally interoperable system-wide information management, optimum capacity and flexible flights–through global collaborative ATM, and efficient flight path–through trajectory based operations.

3. Implementation Guideline

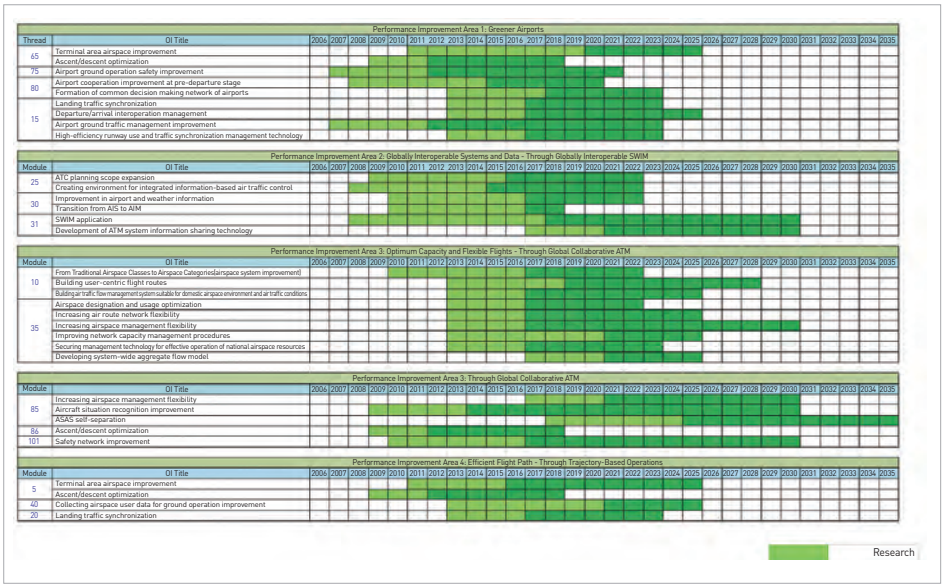
NARAE defines and classifies operational improvements in accordance with ASBU performance improvement areas. Each operational improvement area consists of operational improvement steps. These steps present detailed explanations on step-by-step functions needed for the implementation of

operational improvements. The items for technological requirements for each operational improvement step are described as technical enablers. Initial operational capability of each operational improvement step is determined by its technical enablers. The strength of the ASBU structure is that each operational improvement related to an ASBU module can be readily recognized by performance target area through the component elements based on a global concept.

A total of 28 operational improvements have been defined for NARAE. Nine of them belong to performance improvement area 1 "green airport," and six others to performance improvement area 2 "globally interoperable systems and data–based System Wide Information Management (SWIM)." Of the rest, 12 are in the category of performance improvement area 3 "optimum capacity and flexible flights–based global collaborative ATM", and four belong to performance improvement area 4 "efficient flight path–through TBO." Operational improvement steps presents detailed explanations on step-by-step functions needed for the implementation of operational improvements. Technical enablers represent technological items required for each operational improvement step. These implementation guidelines are provided along with the performance framework form (PFF) that shows each performance improvement and operational improvement area by using a diagram by block.

NARAE will bring favorable changes to the nation's aviation system and further enhance its potential. To ensure its implementation, all-out efforts must be exerted particularly through regional and international integration. NARAE will help domestic airlines attain their business targets both at home and abroad. It will also help the nation play a more active role in the international aviation community, based on its improved aviation-related operational capabilities. The current ATM system is highly depending on human resources under a tactical operational environment. NARAE's short-term aim is to expand its performance capabilities so that it can function properly in the future ATM environment that is likely to be strategic and cooperative in nature. Specifically, it will deal with the following areas:

Figure 6.6 Operational improvement timetable



strategic air traffic flow management, centralization of data management and supply, recognition of demand for R&D for operation, policy and technical enablers, human resources planning and management, performance-oriented ATM application, and integrated safety management. Its long-term goal is to provide a safe and effective air transport environment by improving accommodation capacity, flexibility, predictability, economic feasibility, and environmental management capacity.

Section 4

Implications and Policy Directions

The next generation CNS/ATM is being developed by ICAO and its member states to address the limitations the existing air navigation facilities related to their usage. It is based on a new concept designed to ensure that aircraft can be used anytime and anywhere using data link communication and satellite-based navigation technology.

In an effort to overcome the limitations of existing facilities and to ensure aviation safety for 2020 and beyond amid a surge in air traffic demand, ICAO has devised the Global Air Navigation Plan (ICAO Doc. 9750 Ver. 2002) based on ultra-modern data link communication and satellite-based air navigation technology, and recommended its implementation to the ICAO member states. Accordingly, Korea has established long-term plans to be implemented by 2025, seeking to enhance the safety of aviation, improve its economic feasibility, and ensure efficiency in airspace operation.

Proposed projects need to be carried out on a phased basis in accordance with priorities, given budgetary restrictions. In addition, decisions on the types of equipment to be installed at airports, flight routes, and air traffic control agencies should be made by taking into account ICAO recommendations, international trends and preparedness of airlines. Efforts

should be made to minimize the dual burden of maintaining existing facilities and the new system, which are not interoperable. In order to prevent from confusion and delayed operations, guidelines for operating staff should be prepared in advance with concern to their training, technical certifications, and operating procedures. It is also necessary to operate the system on a pilot basis for a sufficient period of time.

Given Korea's economic size and the latest trends in air traffic growth, demand for passenger and cargo air traffic is likely to exceed capacity within 10 years. This forecast demonstrates the need to increase investments in air transport infrastructure such as airports and air traffic control centers. At the same, emphasis should be placed on ensuring integrative and systematic approaches in dealing with air traffic management and operational procedures. By doing so, future air traffic flow can be managed in advance, thus providing a comfortable and convenient environment for travelers.

Korea is now exerting all-out efforts to comply with international technological and environmental requirements as an ICAO member state, while seeking to establish a user oriented safe and economical air navigation system. Aware of the need for the future air navigation system, the nation has formulated concrete plans to secure an effective air traffic surveillance system and its operational procedures as well as to develop systematic and integrative air traffic policies. Recently, it has demonstrated its resolve to get actively involved in ICAO's plan for transition to the new CNS/ATM system by developing roadmaps such as NARAE and the Mid to Long-Term Comprehensive Plan for Building and Managing Air Navigation System. These roadmaps laid the basis for establishing the desired system by the target year and ultimately securing conditions for safe, swift, correct and economic air transport in the 21st century. In a related move, KOTI conducted research on building future free flight-based infrastructure (2007), future R&D roadmap on air navigation system (2008), basic plan for building future air navigation systems (2009), developing an air navigation system system for supporting green aviation industry (2010), and transition to performance-based navigation (2010). In addition, it is mapping out plans

concerning the operation of the future air navigation system in relation to its development directions and timing. The institute will continue to play a leading role in ensuring efficiency in the operation of the national airspace and airports while making preparations to cope with changes rapidly taking place in the aviation sector.

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Chapter
07

Green Growth and Environmental Policies

Section 1

Greenhouse Gas Emissions in the Aviation Sector

1. Greenhouse Gas Emissions Management and Outlook in the Transport Sector

In 2010, Korea's transport sector generated 84 million tons of CO_2eq, accounting for 13% of the nation's entire greenhouse has (GHG) emissions, which amounted to 668 million tons of CO_2eq.

Table 7.1 GHG emissions in Korea by energy consumption sector (Unit: 1 million tCO_2eq)

Categories	Energy	Industrial processing	Agriculture	Forestry land use	Wastes	Total emissions	Net emissions
Emissions	570.7	62.7	21.3	-39.6	14.2	668.8	629.2

Source: Korea Energy Economics Institute, Statistics DB, www.kesis.net, 2010.

By mode, road transport had the highest share of 94.6% in the transport GHG emissions. It was followed by marine transport (2.7%), aviation (1.5%), rail transport (0.7%), and other (0.5%).

Table 7.2 Trends in emissions by transport mode (Unit: 1 million tCO_2eq)

Categories	1990	1995	2000	2005	2010
Road	30.93	58.58	64.53	76.90	79.82
Rail	0.88	0.94	0.97	0.81	0.56
Air	0.87	1.41	1.49	1.09	1.22
Marine	2.44	3.63	2.75	2.78	2.30
Other	0.26	0.29	0.31	0.36	0.45
Total	35.38	64.85	70.05	81.94	84.35

Source: Korea Transport Emission Management System, Korea Transportation Safety Authority, A 2011 Report on Greenhouse Gas Emissions Produced in Relation to Transport Logistics, www.kotems.or.kr, 2011.

In 2020, the GHG emissions in the road, rail, marine and air transport sectors are forecasted to reach 95.27 million tons of CO_2eq, 820,000 tons of CO_2eq, 14.35 million tons of CO_2eq, and 10.83 million tons of CO_2eq, respectively.

Table 7.3 Emissions forecast by transport mode for 2020 (Unit: tCO_2eq)

Categories	Road	Rail	Marine	Air	Total
Total	95,206,471	812,783	3,263,448	1,293,064	100,575,766
Passenger	62,850,397	620,405	237,601	1,293,064	
Cargo	32,356,074	192,378	3,025,847		

Note: 1) Application the rate of fuel consumption and the rate of emissions depending on the passenger/freight mode in 2008
2) Excluding international bunkering

Source: 1) The Korea Transport Institute, *Transport Demand Survey and Database Construction Project*, Vol. 11, 12, 2010.
2) Ministry of Trade, Industry and Energy, *2008 Energy Consumption Survey*, 2009.
3) Korea Transportation Safety Authority, *Amount of Greenhouse Gas Emissions in the Transport Sector in 2008*, 2010.
4) Ministry of Land, Infrastructure, and Transport, *1st Master Plan for Sustainable National Transport and Logistics Act (2011-2020)*, 2011.

2. GHG Emissions Management and Outlook in the Aviation Sector

In 2011, GHG emissions from aviation bunker fuels worldwide amounted to 468.51 million tons of CO_2eq. The amount in Korea was 11.99 million tons of CO_2eq.[1]

1) International Energy Agency, CO_2 Emissions from Fuel Combustion, 2013.

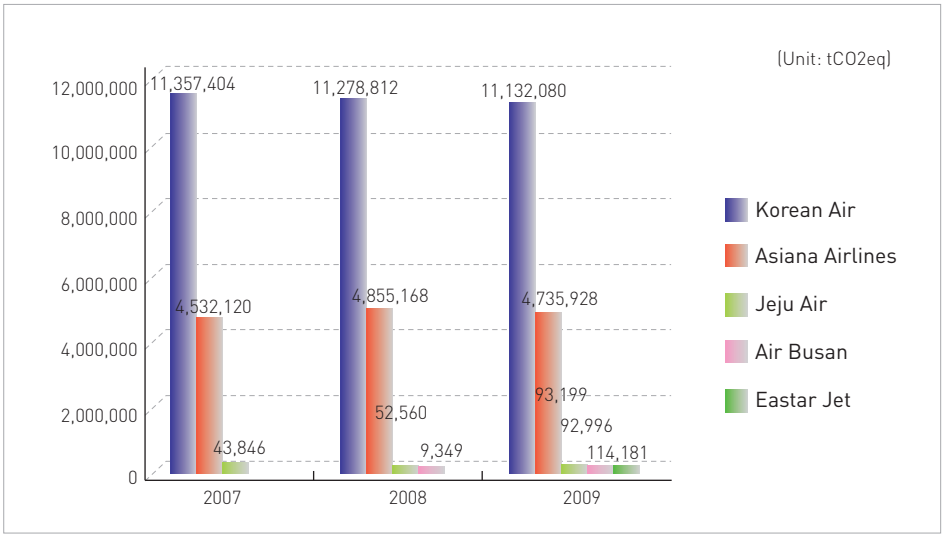
Due to continuous growth in air traffic demand, GHG emissions in Korea's transport sector rose 2% in 2010 from the previous year. Between 1990 and 2010, the emissions increased by an annual average of 4.5%. Aviation-generated emissions are forecasted to expand by 5.6% a year on average.

Air Transport Business Operators' Emissions Management

In 2010, aviation-generated emissions reached 1,221,000 tons of CO_2eq, while those from international aviation bunker fuel consumption amounted to 11,671,000 tons of CO_2eq.

The Ministry of Land, Infrastructure and Transport is operating an information management system on GHG emissions within its integrated aviation safety information system called National Aviation Resource Management Information (NARMI). It is managing transport emissions through Korea Transport Emission Management System (KOTEMS). In order to attain the emission reduction targets for the aviation sector, the ministry is also monitoring emissions generated by the airlines Korean Air and Asiana.

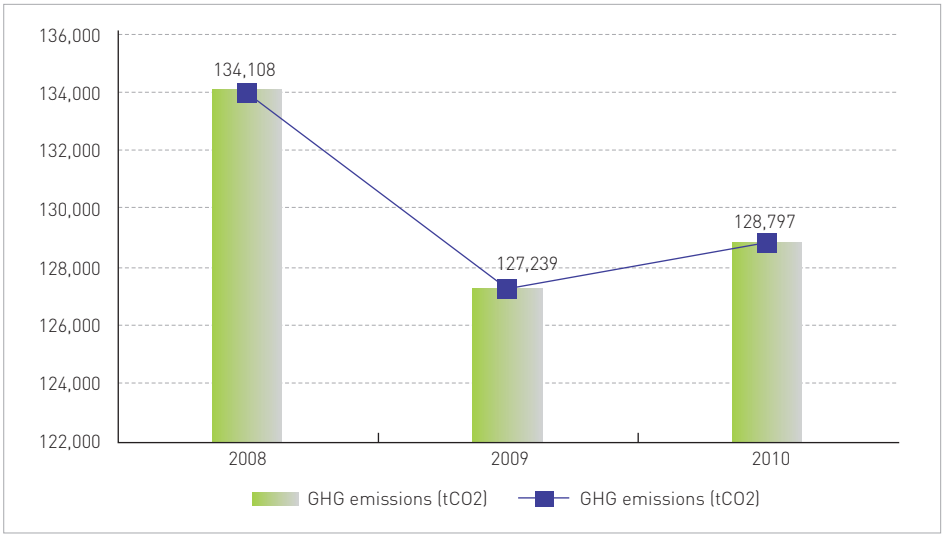
Figure 7.1 Emission trends by air transport operator (Unit: tCO_2eq)



Airport Operators' Emissions Management

In 2009, Incheon International Airport Corporation made an emissions inventory after classifying the operationally controllable facilities into two areas: passenger facility and airport operation. It is estimating the emissions of six GHG stipulated in the Tokyo Protocol.[2]

Figure 7.2 Emission trends at Incheon International Airport Corporation

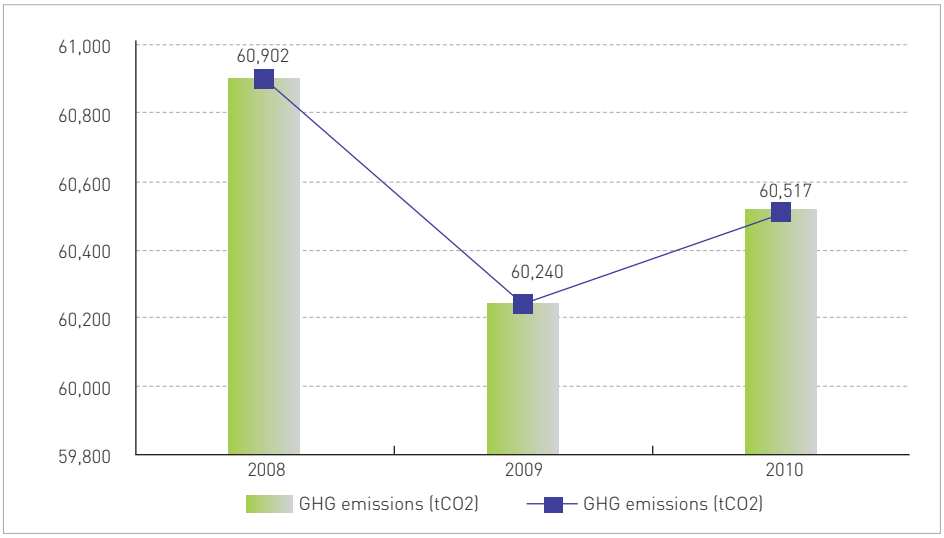


Korea Airports Corporation made an emissions inventory for its 14 airports, the Civil Aviation Training Center, and the Aviation Facilities Headquarters, after estimating the emissions generated from 2004 to 2008. Its estimations cover the emissions produced in relation to airport operation[3] as well as airside and public emissions.

Emissions data are collected through the GHG management system. Then, they are stored in the GHG inventory management system after undergoing

2) Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF6).
3) CO_2, CH_4, N_2O, HFCs, PFCs, and SF6 as stipulated in the Tokyo Protocol.

Figure 7.3 Korea Airports Corporation emissions



the consistency confirmation process.

Ground Handlers' Emissions Management

GHG management by ground handlers is not being implemented in a systematic manner. Instead, airports are collecting data on the amount of electricity used by ground facilities, status of ground support equipment, and relevant fuel consumption and GHG emissions. However, there are limitations in ensuring thorough data on related activities.

Section 2

Greenhouse Gas Emissions Policy in Aviation

1. ICAO Environmental Vision and Targets

ICAO Environmental Targets (2004)[4]

- Prevention and reduction of aircraft noise damage
- Reducing or limiting aircraft engine emissions with regard to regional atmospheric quality
- Limiting and reducing aircraft emission of greenhouse gases contributing to climate change

To formulate countermeasures to reduce greenhouse gases in the international aviation sector, ICAO conducted research after forming the Committee on Aviation Environmental Protection (CAEP)[5] and the Group on International Aviation and Climate Change (GIACC)[6].

4) http://www.icao.int/environmental-protection/Pages/default.aspx
5) Responsible for developing technological countermeasures.
6) Discussion of policy measures (15 countries).

Based on the outcome of relevant research, the Conference of Directors General Climate Group[7] prepared a resolution (draft) in 2010. It was adopted at the 37th ICAO Assembly in October 2010. The ICAO contracting states agreed on the annual emissions growth rate of 4.73% for 2005-2020. They also agreed on average annual fuel efficiency improvement of 2% to 2020.

At the 38th ICAO Assembly, the member states agreed to implement market based measures, which include monitoring, reporting, and verification of emissions.

States Action Plan

The 38th ICAO Assembly adopted a resolution that required all member states to formulate national targets and action plans every three years, and report them to ICAO.

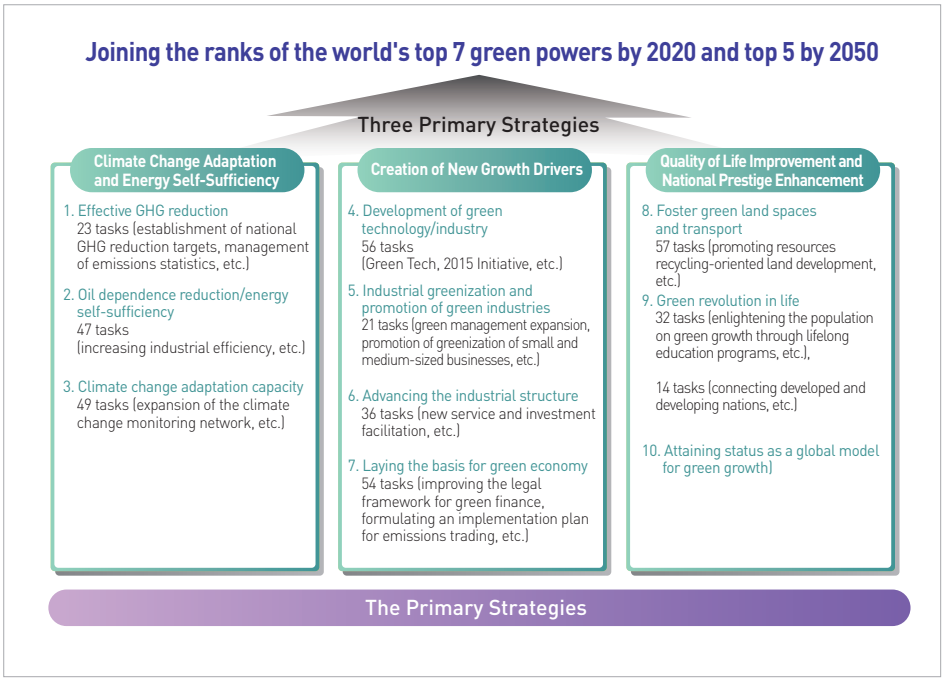
2. Korea's Aviation Environmental Vision and Targets

National Green Growth Strategy and Five-Year Plan (2009)

- Article 9 of the Low-Carbon Green Growth Framework Act
  - Formulation and implementation of a national low-carbon green growth strategy, including policy goals, implementation strategy and major implementation tasks
- Main Contents
  - Matters related to the realization of green technology, green industry and green economic systems
  - Matters related to policies on climate change, energy and sustainable growth
  - Matters related to green lifestyles, green land development, and low-

7) GIACC participants (15 countries) plus Korea, Spain, Singapore and UAE.

Figure 7.4 Vision structure to achieve greener operations



carbon transport systems

– Matters related to international negotiations and cooperation for low-carbon green growth

– Matters related to funding, tax and finance, workforce training, and education and public relations

- Mid-term GHG reduction target - 30% reduction compared to current levels in 2020

Basic Plan for Sustainable Development (2001-2015)

- Implementation of Agenda 21 (Rio de Janeiro, June 1992) and the resolution adopted at the 2002 World Summit on Sustainable Development held in Johannesburg

– Formulation of the 1st national sustainable development strategy and its implementation plan (2006-2010) were submitted to the U.N.

Figure 7.5 Vision structure to achieve sustainable development

Conference on Sustainable Development (UNCSD) (June 2007)

– The 2nd Basic Plan (2011-1015) was submitted to UNCSD before the opening of the Rio+20 Conference (Rio de Janeiro, June 2012)

- (Legal basis) Article 50 of the Low-Carbon Green Growth Framework Act
- 84 tasks for the establishment of climate change adaptation, response systems, and enhancement of the sustainability of the economy and industrial structure

– Implementation of the greenhouse gas and energy target management

Sustainable Transport Logistics Development Plan (2011-2020)

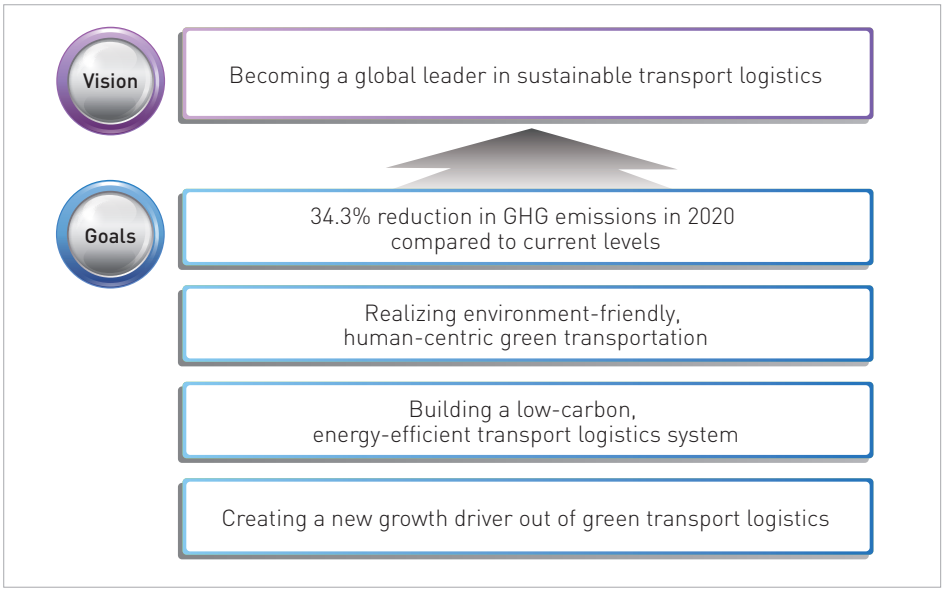
- Article 7 of the Sustainable Transport Logistics Development Act & Article 53 of the Low-Carbon Green Growth Framework Act
- Main Contents

– Current conditions and forecasts concerning energy consumption and GHG emissions related to transport logistics

– Basic policy direction for sustainable transport logistics policies

– Establishment and management of GHG reduction and energy saving targets in transport logistics

Figure 7.6 Vision structure to achieve sustainable transport logistics



  - Measures for development of sustainable transport logistics systems, such as public transport promotion, development of environment-friendly transport logistics facilities, and facilitation of modal shift
  - Laying institutional basis for sustainable transport logistics
  - Financing schemes for implementation of the basic plan
- Ensure Sustainable Transport Logistics
  - Achieved through promotion of energy-efficiency, low-carbon activities in all transport modes such as road (including walking, bicycling), rail, aviation, and waterborne
  - Primarily focused on establishment and management of GHG reduction targets, funding measures, facilitating a modal split change, and laying the implementation basis
- Implementation Plans by Strategic Task
  - Strengthening traffic demand management and increasing efficiency in transport operations: curbing use of passenger cars through Transport Demand Management (TDM) techniques, ensuring efficient operation of existing traffic facilities through use of IT, simultaneous application

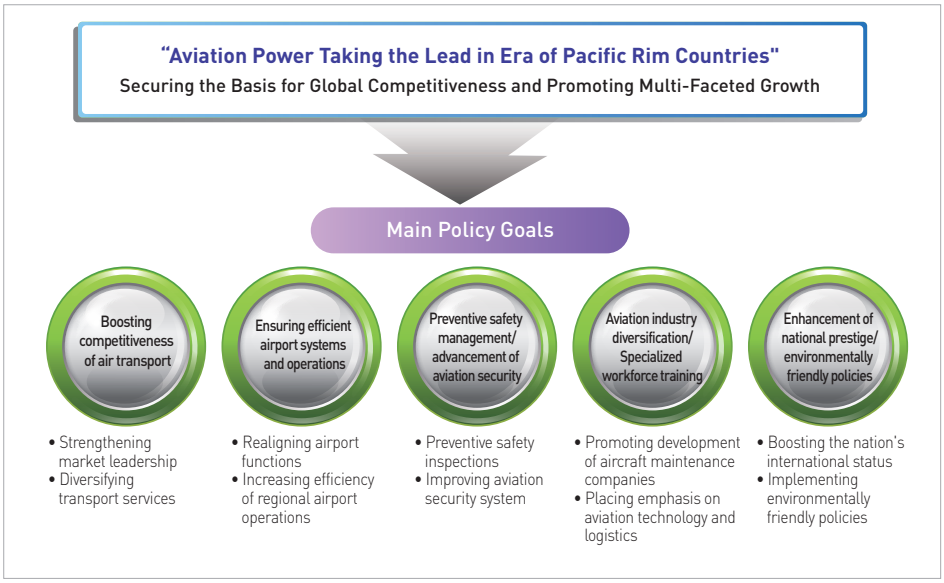
of regulations and incentives for restricting use of passenger cars and promote green transport, and intensify education and PR efforts for green transport facilitation

– Promotion of walking and cycling in daily lives: fostering human-centric environments such as pedestrian zones, steady expansion of bicycle infrastructure, expansion of facilities for connecting bikes and public transport, and promote the use of non-motorized, no-carbon modes of transport through education and PR efforts
– Expansion of public transport infrastructure and improvement of services: continuous expansion of public transport such as urban railways and bus rapid transit, building a system of public transport that is faster and more comfortable than passenger cars, increasing operational efficiency of public transport modes, and strengthen connections between public transport and other modes of transport
– Building a low-carbon green logistics system: establishing carbon reduction-oriented logistics systems, facilitating shifts to green modes of transport, expanding cargo transport capacity of railways, and promoting coastal shipping
– Development of environment-friendly transport logistics technologies: promoting development and use of green cars, development of vehicles for increasing efficiency of railway operations, development of eco-friendly cargo transport modes and facilities/equipment, design and operation of low-carbon highways, improve aircraft fuel efficiency, and development of green technologies for marine transport/ports

1st Basic Plan for Aviation Policy (2010-2014)

- Article 2-5 of the Aviation Act
- Main Contents
  – Current conditions and problems of the nation's aviation sector
  – Changes in aviation environment and outlook
  – National aviation policy goals, strategies and phased implementation

Figure 7.7 Vision structure to achieve leadership in Pacific Rim countries



tasks

– Formulation of implementation plans by aviation sector

– Investment and funding schemes for the Basic Plan for Aviation Policy

– Implementation and management of the Basic Plan for Aviation Policy

• Pursuing Low-Carbon Green Growth in Aviation

· Formulating mid to long-term plans for low-carbon green growth in the aviation sector

· Building an aviation GHG emissions management system

· Promoting a voluntary aviation emissions reduction agreement

– Exertion of domestic GHG abatement endeavors through implementation of voluntary accords of airports, a GHG and energy targets management system, and enforce the EU Emissions Trading Scheme

– Korea Airports Corporation and Incheon International Airport Corporation emissions management: establishment and management of reduction targets for airport facilities as part of the construction sectors

Section 3

Aviation Green Growth Policy: Cases of Success and Limitations

1. ICAO States' Action Plan

- Basic Contents of ICAO Market-Based Measures[8]
  - State and regional action programs are being implemented based on their own standards and plans. ICAO recommends market-based measures are implemented including environmental levies[9], emissions trading system[10], and voluntary measures.[11]
- State Action Plan of Korea
  - Establishment of the 5-Year Green Growth Plan (2009-2013) in accordance with the Low-Carbon Green Growth Framework Act.

8) Resolution 38-19: Consolidated statement of continuing ICAO policies and practices related to environmental protection-climate change.
9) Levies imposed by the state or local governments for the purpose of ensuring environmental protection. They are levied on goods or services that cause environmental damages.
10) Under this scheme, a cap or limit is set on the total amount of greenhouse gases that can be emitted. It is them allocated to nations, industries or firms, and subsequently traded in the form of "emission rights" according to market principles directly among the participants or through exchanges.
11) Measures to mitigate GHG unilaterally taken by the industry or through a voluntary agreement between the industry and the government.

Table 7.4 Guiding principles for ICAO market based measures

① Supporting sustainable development of international aviation
② Maintenance of fairness in relation to other sectors
③ Cost-effective reduction
④ Transparency
⑤ Contributing towards achieving global aspirational goals
⑥ Prohibiting duplication
⑦ Prevention of market distortions and application of nondiscriminatory principles
⑧ Minimizing carbon leakage
⑨ Facilitating appropriate access to all carbon markets
⑩ Implementation based on bilateral agreements
⑪ Application of revenues to aviation emissions mitigation and adaptation
⑫ Common but differentiated responsibilities and capacity as well as nondiscriminatory, fair and equitable opportunities

Source: Ministry of Land, Transport and Marine Affairs, conference material on voluntary GHG reduction agreement for the aviation sector, July 2010.

Table 7.5 Korea's market-based response system

Categories	Contents	Implications
Carbon tax	• Introduced in accordance with the Low-Carbon Green Growth Framework Act • Linked to emission trading system to prevent weakened competitiveness of domestic enterprises • Lowering income tax rates in return for introducing carbon tax in order to ensure revenue neutrality. Designed to help attain GHG reduction targets through the burden of taxation[12]	• High short-term effects in GHG mitigation • Impacts on aviation industry minimized through tax neutrality • Low implementation costs • Difficult to adjust tax rates due to difficulty in estimating marginal external cost • Industrial competitiveness to be weakened due to the price effect and virtual ban on entry into the aviation industry
Emissions trading system	• Based on the Act on the Allocation and Trading of Greenhouse Gas Emission Rights • Formulation of a basic implementation plan for emissions trading • Plan to establish carbon rights exchanges	• Possible to attain environmental targets with minimal costs • Possible to ensure direct control of pollutant emissions • Effectively promoting development of sophisticated technologies • Possible to ensure effective resource allocation • Auctioning allowances likely to ensure high efficiency in GHG mitigation within a short period of time • High costs related to surveillance, administration and trading • Risks caused by market uncertainty • Establishment of optimum environmental targets in advance • Low in GHG mitigation effects in the event of free allocation of emission allowances
Voluntary agreement	• Based on guidelines on the operation of voluntary agreements for facilitating aviation GHG mitigation activities • Voluntary agreements signed between participating enterprises and competent authorities	• Minimization of economic impacts on airlines • Ensuring corporate autonomy • Long-term advantages for actively participating enterprises • Low in effectiveness with regard to GHG mitigation • Impossible to maintain a long-term system

Source: The Korea Transport Institute, A Scheme to Introduce a Market-Based System for Green Growth of the Aviation Industry, Revised in 2010.

12) Article 30 of the Low-Carbon Green Growth Framework Act

2. Voluntary Reduction Agreement

Guidelines on the Operation of Voluntary Agreements was enacted to promote national flag carriers' GHG mitigation activities in the international aviation sector.

This scheme is designed to facilitate GHG reduction through signing voluntary agreements between the Ministry of Land, Infrastructure and Transport and air transport business operators as well as performance verification by assessment agencies.

Table 7.6 Basic contents of voluntary agreements

Categories	Contents
Target area	• GHG emissions in international aviation
Legal basis	• Article 53 of the Low-Carbon Green Growth Framework Act & Article 41 of the Enforcement Decree of the Act • Guidelines on the Operation of Voluntary Agreements for promotion of aviation GHG mitigation activities (February 2011)
Target airlines and scope	• 1st agreement (August 1, 2010 - July 31, 2011): Korean Air, Asiana Airlines, Jeju Air • 2nd agreement (January 1, 2012 - December 31, 2012)[13]: The first three airlines plus Jin Air, Air Busan, Eastar Jet • 3rd agreement (January 1, 2013 - December 31, 2013): All previous airlines plus T'way Air • 4th agreement (January 1, 2014 - December 31, 2014): Korean Air, Asiana Airlines, Jeju Air, Jin Air, Air Busan, Eastar Jet, T'way Air • 5th agreement (January 1, 2015 - December 31, 2016): Korean Air, Asiana Airlines, Jeju Air, Jin Air, Air Busan, Eastar Jet, T'way Air
Target pollutant	• CO_2
Setting reduction targets	• Fuel efficiency improvement • ICAO (annual fuel efficiency improvement of 2%), IATA (annual fuel efficiency improvement of 1.5%), voluntary agreements • 1st agreement: Korean Air (2.5%), Asiana Airlines (2.5%), Jeju Air (4%) • Performance: Korean Air (3.09%), Asiana Airlines (5.76%), Jeju Air (7.6%) • 2nd agreement: Korean Air (2%), Asiana Airlines (2%), Jeju Air (3%), Jin Air (3%), Air Busan (3%), Eastar Jet (3%) • 3rd agreement: Korean Air (2%), Asiana Airlines (2%), Jeju Air (3%), Jin Air (3%), Air Busan (3%), Eastar Jet (3%), T'way Air (3%) • 4th agreement: Korean Air (2%), Asiana Airlines (2%), Jeju Air (3%), Jin Air (3%), Air Busan (3%), Eastar Jet (3%), T'way Air (3%) • 5th agreement[14]: Korean Air (2%), Asiana Airlines (2%), Jeju Air (3%), Jin Air (3%), Air Busan (3%), Eastar Jet (3%), T'way Air (3%)
Reduction criteria	• Application of differentiated criteria depending on total emission volumes of airlines (5% for enterprises whose emissions do not exceed 500,000 tons, 2% for those whose emissions surpass 500,000 tons)[15]
Rewards for target attainment	• Provision of incentives[16]

Sources: 1) Ministry of Land, Infrastructure, and Transport, *Manual for Voluntarily Implementing Agreement for Reduction of Aviation Greenhouse Gas Emission*, 2012.
2) Ministry of Land, Infrastructure, and Transport, All Seven National Airlines Participate in Reduction of Greenhouse Gas Emissions, Press Release, 2014 Sept. 24.

Table 7.7 Basic contents of the Greenhouse Gas and Energy Target Management System

Categories	Contents
Target area	GHG emissions in domestic air transport
Legal basis	Article 42 of the Low-Carbon Green Growth Framework Act, Article 26 of the Enforcement Decree of the Act, guidelines on the operation and management of greenhouse gas and energy targets
Target airlines and scope	• Korean Air, Asiana Airlines[17] in 2011 • Jin Air, Air Busan, Jeju Air, Eastar Jet were included beginning in 2012
Target pollutants	CO_2, CH_4, N_2O
Setting reduction targets	• Volume-based method • Sectorial targets set by considering the national GHG reduction targets (30% reduction in 2020 compared to current levels)
Reduction criteria	Application of differentiated criteria depending on total emission volumes of airlines[18]
Rewards for target attainment	Incentives awarded to entities attaining the targets (early reduction records were recognized when the emission rights trading system is implemented); Imposition of fines on entities that fail to achieve targets

Source: Ministry of Land, Infrastructure and Transport, Materials to Cope with U.S. State Department Voluntary Programs, revised in 2011.

- Implications
  - Incentives were provided to airlines that achieved the reduction targets set in the 1st agreement. In the 2nd agreement differentiated targets were set based on the results of the 1st agreement in order to promote competition among the airlines. Negotiations on the 5th agreement has been completed in 2014.
  - Most airlines over-achieved the fuel efficiency improvement targets by exerting efforts to save fuel and increase the load factor

13) T'way Airlines signed the agreement after 2012 as it began operation from September 2010.

14) From the 5th agreement the application period changed to two years and a reduction agreement was finalized for international flights.

15) Past emissions criteria (2007-2009) was determined at a three-way meeting among the government, Korea Transportation Safety Authority, and airlines.

16) Incentive and commendation from Minister of Ministry of Ministry of Land, Infrastructure, and Transport is provided to the most efficient company and the company which improves best. Not only that, the result of agreement on voluntarily implementing emission reduction is applied to evaluation for distribution of international aviation right from March 1, 2014. Before that, all airlines is grant 4.0 point which is the basic mark.

17) Enterprises whose GHG emissions amount to 125 kton and whose energy consumption reach 500Tj as of September 2010.

18) * Methane and nitrous oxide emissions are converted into equivalent values of carbon dioxide.
* 5% of CO_2eq emissions at workplace. Percentage is set at 2% for workplaces whose emissions exceed 500,000 CO_2eq.

– There were differences among the airlines in ways they used to estimate fuel saving effects. This demonstrated the need to develop an appropriate approach for estimating the effects and share relevant information.

3. Greenhouse Gas and Energy Target Management System

The greenhouse gas/energy target management system refers to a scheme in which the government sets GHG emissions or energy consumption targets for designated entities through negotiated agreement. The government provides incentives or imposes penalties (correction orders or fines) based on measurement, reporting, and verification of the entities' achievements.

- Implications
  – Early reduction records can be recognized in the future when the emissions trading system is implemented
  – There is a possibility of duplicative application of reduction targets in the target management system and voluntary agreement scheme

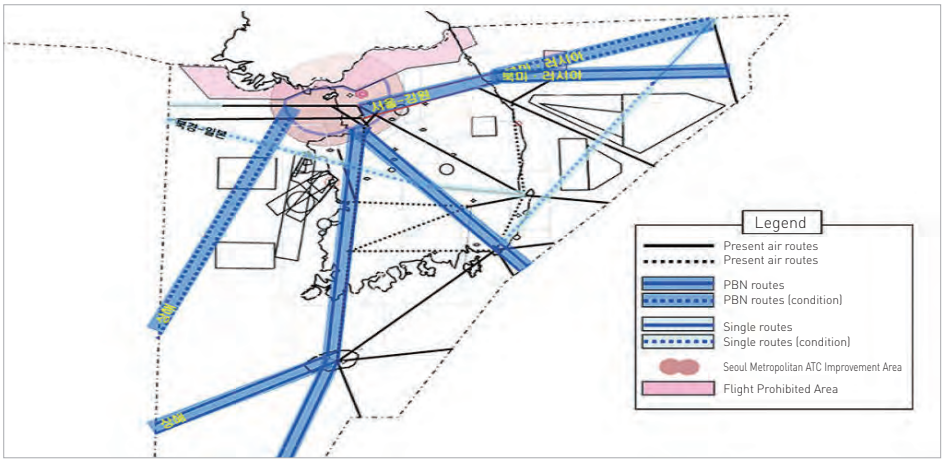
4. Action Programs for Supporting National Reduction Plans

Aircraft Replacement

The average fleet age of Korean airlines is low as fleets in operation have

Figure 7.8 New aircraft from Airbus and Boeing

Figure 7.9 Double tracking of routes



a number of newer aircraft. Thus, they display relatively high levels of fuel efficiency. They are slated to introduce a total of 108 new aircraft, or an average of 18 planes a year, by 2017. However, low-cost carriers are financially incapable of introducing a large number of new aircraft.

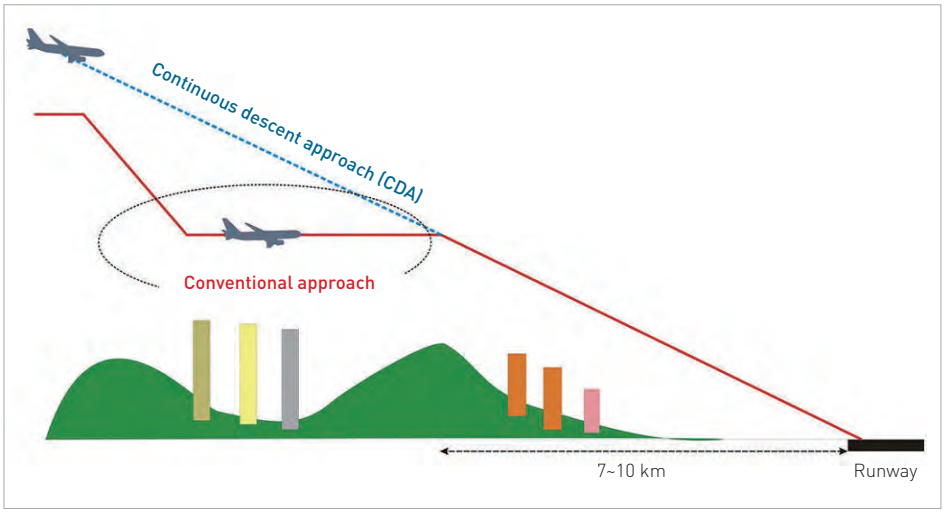
Air Traffic Control and Infrastructure Improvement

- Curbing the Use of Auxiliary Power Unit (APU)[19]
  - The use of ground power units (GPU[20]/AC-GPS[21]) is recommended in order to save fuel and lengthen the life of aircraft auxiliary power units
  - Constraining factors: occurrence of noise and difficulty in maintaining optimum temperature inside aircraft
- Introduction of the Performance-Based Navigation[22]

  Performance-based navigation represents a new concept based on area navigation which ensures flexible flight paths and thus making it

19) Normally a small-size gas turbine engine. It supplies power to start the main engine and provides electricity to the aircraft
20) Diesel generated power supplied for use inside aircraft.
21) Diesel generated power supplied for use inside aircraft.
22) Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure, or in a designated airspace.

Figure 7.10 Conceptual map for continuous descent operations

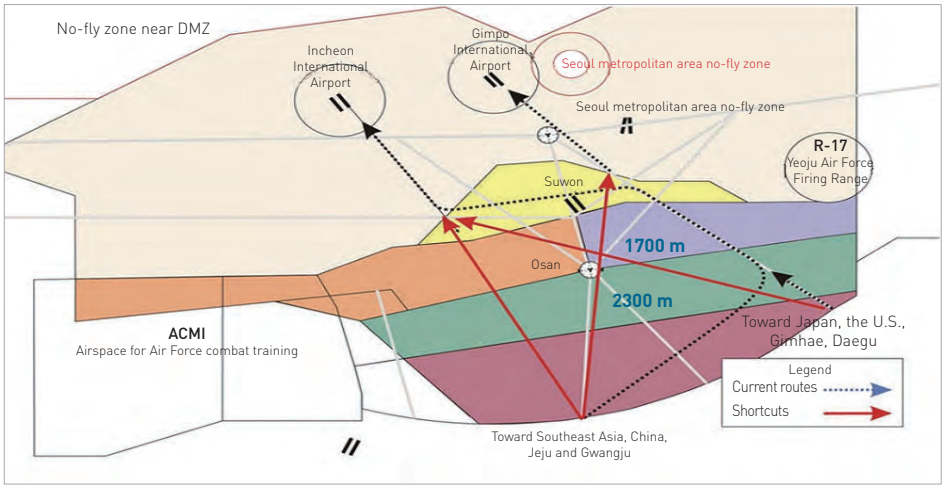


possible to reduce flight distance and eventually save aircraft fuel

– Introduction of performance-based navigation leads to improvement in precision navigation. By ensuring double tracking of parallel routes, it can help prevent flight delays on congested routes.

Fuel consumption, aircraft noise and the discharge of pollutants can be

Figure 7.11 Flight shortcuts



significantly reduced through the implementation of continuous descent operations or the continuous descent approach. These schemes allow an arriving aircraft to descend continuously to the greatest possible extent by using its advanced air navigation system.

  - Constraining factors: with dual tracking of routes there could be various operational, technological, and economical restrictions. The continuous descent approach faces restrictions when using congested airports. Thus, it is chiefly used during nights.

- Use of Shortcuts
  - It is essential for airlines to develop flight shortcuts in order to achieve their fuel conservation targets
  - Constraining factors: Korean airspace is mostly under the jurisdiction of the military. This places restrictions on developing or extending shortcuts.

Improvement in Operational Efficiency

- Contingency Fuel Improvement[23]
  - In April 2012, ICAO announced a plan to adopt a 5% contingency fuel rule through revision of its aircraft fuel requirements in November. Of the seven Korean airliners, Korean Air, Asiana Airlines and Jin Air are operating flights with 5% contingence fuel, instead of the required 10 after gaining approval from the Minister of Land, Infrastructure and Transport.
  - Constraining factors: Korea is expected to accept the revised ICAO rule on contingency fuel.[24] However, the lowered contingency fuel percentage might serve as a risk factor depending on piloting habits.
- Improvement in Aircraft Cost Index[25]

23) Fuel loaded into aircraft is classified into trip fuel and reserve fuel. Reserve fuel is further divided into three categories: alternate, holding, and contingency.

24) The Minister of Land, Infrastructure and Transport may approve a change if an analysis of airlines' flight and fuel consumption data shows it would cause safety problems.

25) The cost index represents the rate of time cost to fuel cost and is provided by aircraft manufacturing companies.

  - Optimization of the aircraft cost index through flight data analysis could contribute to fuel conservation
  - Constraining factor: in Korea, full service carriers are periodically improving the aircraft cost index. However, low-cost carriers are finding it difficult to periodically analyze and update relevant data due to shortages of management personnel and equipment.
- Single Engine Taxiing[26]
  - The single engine taxi program is designed to reduce aircraft emissions and conserve fuel. It does not require additional investment costs as it can be implemented based on the intention of airlines and flight crew.
  - Constraining factor: it takes longer to move from the runway to the terminal after landing
- Engine Washing
  - This method refers to the cleaning of compressor bypasses by spraying an appropriate amount of water through the engine. Removing foreign substances from the engine combustion space can help improve fuel efficiency.
  - Constraining factor: washing can be constrained by fleet operation schedules as well as other factors such as manpower allocation and expenses
- Use of Idle Reverse Thrust
  - The use of idle reverse thrust when landing can contribute to noise reduction and fuel conservation
  - Constraining factor: the use of flaps without reverse thrust is fairly common during take-offs. During landing it may cause longer taxiing time.
- Use of Light-Weight Unit Load Device
  - Fuel can be saved through the replacement of the existing unit load devices with light-weight versions
  - Constraining factors: Airlines are exerting continued efforts to replace the old unit load devices with light-weight models. Yet, they are facing constraints of cost and the fixed container operating system.

5. EU Emissions Trading Scheme

The EU launched a CO_2 emission trading scheme in 2005 for five sectors, including power generation, steel and chemicals. In 2002, it was extended to cover international aviation as well. However, the Emissions Trading Scheme (ETS) for the international aviation sector was suspended due to opposition from other countries.

Table 7.8 Key facts of the EU emissions trading scheme

Categories	Contents
Application targets	• Flight to and from EU airports, except for training/official business flights and aircraft whose maximum takeoff weight is less than 5,700 kg
Legal basis	• EU Directive 2008/101/EC
Target airlines and scope	• Korean Air, Asiana Airlines (airlines serving destinations within EU)
Target pollutant	• CO_2
Cap setting	• Cap and trade scheme • 85% for free allocation, 15% for auctioning based on the EU's average annual emissions between 2004 and 2006
Allocation among airlines	• Allocation in accordance with paid transport rates of each airline in 2010
Penalties	• Imposition of penalties if emissions exceed the allocated allowances

On March 7, 2011, the EU Commission announced caps for the aviation emissions trading system scheduled to be implemented from January 2012.

- Emission ceilings: 213 million tons of CO_2eq for 2012, 2013 (209 million tons of CO_2eq for 2013
- Basis of calculation: 95-97% of 219 million tons of CO_2 based on 2004-2006 fuel consumption data
- Allowances to be allocated to airlines free of charge were announced based on the results of monitoring of the airlines' emissions in 2010.[27]

26) This program refers to the shutting down of an engine while taxiing. Various airlines recommend single engine taxiing as a standard operational procedure.

27) Of the total emission allowances, 82% are allocated to airlines free of charge based on their performance and 15% are allocated through auctions. The remaining 3% is kept in reserve.

Table 7.9 Impacts on Korean airlines

• Flight performance and CO_2 emissions: 11,026 flights/ 2.27 million tons (as of 2010) • (Estimation) Free allocation: about 2.6 million tons • (Estimation) Allowances were purchased (2012): about 0.4 million tons (10 to 21 billion won)

Note: Based on data provided by Korean Airlines, April 2011.

- Implications
  - Korean airlines operating flights to the EU are getting ready for the emission trading scheme, helped by various domestic GHG reduction policies such as the greenhouse gas/energy target management system and the voluntary reduction agreement scheme.
  - Airlines of Non-Annex I Parties to the Kyoto Protocol have no other choice but to follow the EU-ETS policy in order to operate flights within the EU. In this respect, the EU-ETS goes against the relevant ICAO policy.
  - Airlines of EU member states have been following the EU emissions reduction policy for their domestic flight operations. Thus, airlines of Non-Annex I countries suffered disadvantages, with EU airlines gaining unexpected benefits, in 2012.

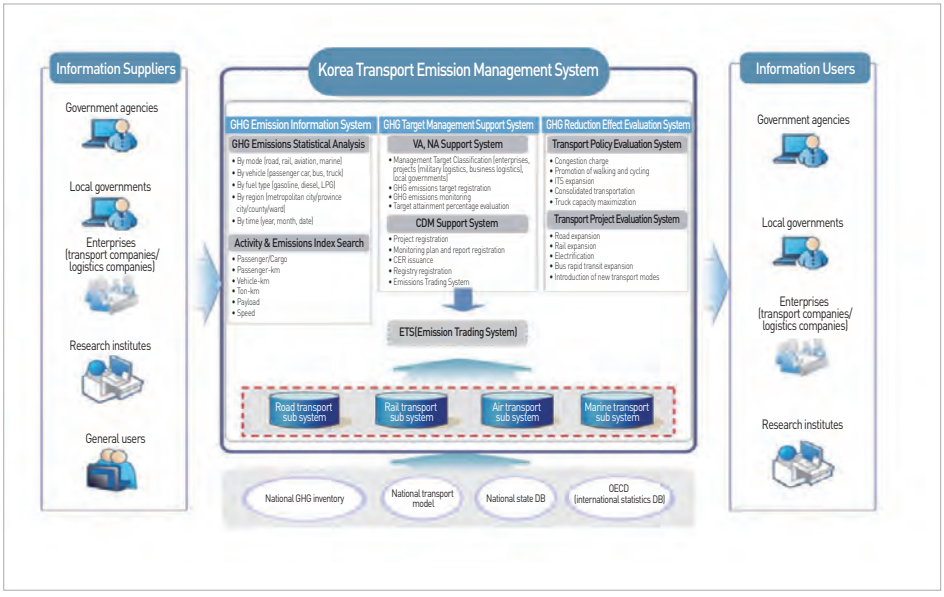
6. Korea Transport Emission Management System

- Korea Transport Emission Management System (KOTEMS)
  - Work is underway to develop the Korea Transport Emission Management System in accordance with Article 15 of the Sustainable Transport Logistics Development Act and Article 14 of the Enforcement Decree of the Act
  - Need to set aviation emissions reduction targets and verify achievements through objective data
  - State-level management of GHG inventory by transport sector (road/rail/aviation/marine), establishment of reduction targets and verification for major emitters, assessment of GHG emissions

mitigation effects of various transport policies and projects

- Implications
  - It is possible to collect aviation GHG emissions through the National Aviation Resource Management Information system operated by the Ministry of Land, Infrastructure and Transport and KOTI's KOTEMS.
  - Emissions are estimated based on the amounts of fuel actually used by airlines for scheduled, non-scheduled, and chartered flights
  - National Aviation Resource Management Information system primarily serves as a database on greenhouse gases. In contrast, KOTEMS is an inventory system that can support emissions data utilization as well as voluntary reduction activities.
  - GHG emissions data provided by KOTEMS will make it possible to predict GHG emissions, formulate reduction strategies, and verify reduction records

Figure 7.12 KOTEMS operating system



Section 4

Directions for Improving Aviation Green Growth Policies

1. Evaluation of Green Growth Policy Implementation in the Aviation Sector

ICAO States' Action Plan

Differences existed among ICAO member states over implementation of market-based measures. To address this problem, ICAO recommended individual states and regional groups formulate and implement their own market-based response programs. Complying with the recommendation, Korea formulated a five-year low-carbon green growth plan, setting GHG reduction targets based on domestic conditions. The proposed carbon tax might overlap with the present emission charges, causing controversy over dual regulation. Thus, it would be desirable to maintain the existing energy tax instead of introducing a carbon tax. The government has formulated a basic implementation plan for the emission trading system. It is also laying the basis for creating carbon markets through implementation of pilot projects as well as enactment of the Act on Allocation and Trading of Greenhouse Gas Emission Rights. In addition, the government is preparing a third voluntary

reduction agreement as the two previous agreements contributed significantly to GHG reduction.

Voluntary Reduction Agreement

Most Korean airlines attained fuel efficiency improvement targets through efforts to conserve fuel and increase load factors. Currently, the agreement is valid for one year which requires renewal annually. The term needs to be extended given the fact that international air transport is sensitive to changes in international environments, particularly with regard to global economic conditions and oil prices. The voluntary reduction agreement should be valid for at least two years and it would be desirable to assess achievements based on cumulative average.[28] Additionally, it is necessary to develop a system for evaluating fuel efficiency separately for various emission reduction measures.

Measures to Support Voluntary Reduction Agreement Activities

A diversity of measures needs to be developed in order to help increase fuel efficiency and facilitate implementation of the government's green growth policy. Enterprises are currently carrying out a variety of mitigation activities based on voluntary agreements, thus making significant progress in efforts to slash GHG emissions. Such activities need to be supported through formation of a consultative body involving the government, airlines, and airport corporations. Other supportive programs should include workshops and research on the efficiency of various policy means related to GHG mitigation. Also needed are establishment of infrastructure to expedite the industrial community's reduction efforts, provision of support for development of environmental energy technologies, and expansion of financial assistance.

28) Evaluation Judges at the Consultative Body for Aviation GHG Voluntary Reduction, *Implementation Performance of the Voluntary Reduction Agreement in the Aviation Sector*, August 2012, p 18.

Greenhouse Gas and Energy Target Management System

Ensuring effective operation of the GHG and energy target management system, which is at the beginning stage, requires harmonization of mitigation targets and means. In particular, it is necessary to develop a GHG statistics estimation system and an integrated operation scheme for both the voluntary agreement and target management system.

EU-ETS

Endeavors should be made to increase the share of Korean airlines in the free allocation of emission allowances in the EU-ETS system. At the same time fuel efficiency of the domestic airlines should be improved. Through such efforts emission allowances that should be purchased by Korean airlines could be minimized to the utmost possible extent.[29] The government and airlines have made remarkable progress in their effort to improve fuel efficiency through the voluntary reduction agreement scheme.

NARMI and KOTEMS

These systems are primarily aimed at collecting GHG emissions data. They need to be further developed so that they can be used for the implementation of various reduction policies such as the voluntary agreement and the target management system.

29) • Maximize the amount to be allocated to Korean airlines by increasing their paid transport volumes to the utmost possible extent in 2010, the base year for setting allocation criteria.
• Minimize the purchase of emission allowances by putting new aircraft on EU routes to reduce emissions in 2011 and beyond.

2. Directions for Improving Aviation Green Growth Policies

In Korea, improvement in income levels and continuous growth in exports are driving up demand for international air traffic. Growth in demand for air traffic services is predicted to cause an annual increase of 5.6% on average in the nation's aviation GHG emissions. Growth in demand inevitably leads to an increase in the absolute amount of emissions. This demonstrates the need to continuously implement GHG mitigation policies.

It is necessary for Korea to get involved in ICAO's preliminary work for a GHG regulatory structure. Also, efforts should be made to develop a methodology for analyzing the effects of policy measures and secure measured data in order to attain the GHG reduction targets.

Korea needs to reorganize the GHG emissions data build-up system and actively promote relevant R&D projects. The reliability of data as well as data collection convenience needs to be ensured by improving the system for collecting information on aircraft emissions. Research should be conducted on methodology for analyzing the effects of market based measures and policy means. At the same time, efforts should be made to secure measured data. These efforts will help Korea increase its level of global contribution and improve its international status.

To sum up, emphasis should be placed on the following measures: preparation of rational alternatives to the voluntary agreement, facilitation of a three-way conference among the government, airlines, and airport corporations for fuel efficiency improvement, introduction of market based measures, and formulation of measures for biofuel promotion. Efforts should also be made to build social infrastructure to facilitate GHG reduction endeavors, provide tax incentives in relation to development of environmental energy technologies and the expansion of financial assistance.

Section 5

Aircraft Noise Policies

1. Laws and Policies Related to Aircraft Noise

In December 1991, the Aviation Act was revised (enforced beginning on July 1, 1992) to lay the legal basis for the establishment of aircraft noise prevention measures and noise criteria as well as imposition and collection of relevant charges. This represented the government's effort to prevent the escalation of noise pollution and provide assistance to residents suffering from aircraft noise. In 1987, the Ministry of Construction and Transportation (presently, the Ministry of Land, Infrastructure and Transport) restricted night (23:00-06:00) aircraft maintenance and flights. Beginning in January 1988, the government banned the flights of Class 1 high-noise aircraft such as the DC-8 and B707.

In March 2010, the government enacted the Airport Noise Prevention and Areas Assistance Act to prevent aircraft noise and effectively implement noise countermeasures and resident support projects, thus increasing the welfare of residents, guaranteeing a comfortable living environment, and facilitating aviation development. The legislation laid the groundwork for launching world-class noise countermeasures, improving the welfare and

Table 7.10 Projects to cope with airport noise and support residents

Categories	Definition	Contents
Projects to cope with airport noise	Projects to reduce airport noise and create a comfortable living environment and include matters stipulated in subparagraph 1-6 of Article 8-1	1. A project for installing soundproof facilities and air conditioning facilities 2. A project for subsidizing TV license fees (limited to a facilities manager) 3. A project for partially subsidizing electricity fees for air conditioning facilities to schools and recipients of basic living subsidies (limited to a facilities manager) 4. A project for installing automatic noise measuring networks 5. A project for investigating noise effect levels 6. Compensation for relocation and purchase of land
Projects for supporting residents	Projects implemented to increase residents' welfare and income and include matters stipulated in Article 19-1	1. Projects for residents' welfare: referring to projects prescribed by Presidential Decree as projects for improving residents' welfare, such as the establishment of common use facilities (library, sports park, etc.), educational and cultural projects, etc. 2. Projects for increasing income: referring to projects prescribed by Presidential Decree as projects that may contribute to increasing income, such as establishment of places for group work, joint farming facilities, etc.

Table 7.11 Aircraft noise-related laws and key contents

Laws	Main contents
Aviation Act	• Operating Procedures, etc. for Abatement of Noise (Article 108-2)
Airport Noise Prevention and Areas Assistance Act	• Designation, Announcement, Etc. of Areas Requiring Countermeasures against Noise (Article 5) • Restrictions on Installation of Facilities in Areas Requiring Countermeasures against Noise (Article 6) • Formulation of Mid-Term Plans for Prevention of Airport Noise and Support for Residents (Article 7) • Formulation, Etc. of Plans for Projects to Cope with Airport Noise (Article 8) • Responsibility of Noise Reduced Flights and Installation of Automatic Noise Measuring Networks (Articles 9 - 10) • Compensation for Relocation, Purchase of Land, Etc. (Articles 11 - 15) • Establishment of Noise Levels of Aircraft & Imposition and Collection of Charges (Articles 16 - 17) • Formulation, Etc. of Plans for Supporting Projects (Articles 18 - 19) • Designation of Development Areas in Noise Damaged Areas and Implementation, Etc. of Development Projects (Articles 20 - 21) • Establishment and Functions of Committee on Countermeasures against Airport Noise (Article 22) • Funds, ETC. (Articles 23 - 29)
Noise and Vibration Control Act	• Control of Aircraft Noise (Article 39)

living standards of residents and systematically securing funding resources (Table 7.10).

Additionally, the government amended the Noise and Vibration Control Act in 1999, securing the legal basis for taking noise prevention measures around airports where aircraft noise exceeds the legally admissible level.

In December 2010, the government formulated the first mid-term plan for prevention of aircraft noise and support for residents (to be renewed every five years) pursuant to Article 7 of the Airport Noise Prevention and Areas Assistance Act. The plan included programs to mitigate noise, improve airport structure, implement countermeasures in areas near airports, support residents in areas affected by aircraft noise, secure funding resources, and allocate budget to various projects.

2. Policy Directions

Policy directions related to aircraft noise can be divided into the following five categories:

First, the second mid-term plan for prevention of aircraft noise and support for residents needs to be substantially improved. Improvement should be based on the evaluation of the first plan and correction of its deficiencies, review of the airport noise mitigation measures, analysis of their impacts, and realignment of the scope of support and methods of providing support. In addition, the second plan should be consistent, environment-friendly and future-oriented.

Second, information services for the public needs to be expanded. In accordance with the government's 3.0 policy guide, which calls for transparency, various and substantial contents ought to be prepared to ensure effective operation of the noise-related information and support system.

Third, there should be a paradigm shift in implementing measures to cope with aircraft noise. Specifically, the government plans to complete the house soundproofing project in 2015 and the project to install air conditioning facilities at the relevant houses in 2020. It is also seeking to provide direct and indirect compensation in relation to aircraft noise, expand the scope of projects to support residents, and respond to various requests made by pertinent local governments.

Fourth, it is necessary to set new criteria for noise. Currently, anti-noise regulations are applied in a uniform manner but need to be applied in a differentiated manner: more stringently for high-noise aircraft and less rigorously for low-noise planes. In addition, the criteria for installing automatic noise measuring networks needs to be readjusted.

Fifth, efforts should be made to promote cooperative ties with residents and local governments. As part of such efforts, the government will expand projects to support residents while providing assistance to the Seoul city government in conducting epidemiological surveys and manufacturing noise maps. The government also plans to secure a settlement scheme for resident support projects and ensure timely notification when changing the purpose of facilities.

3. Policy Achievements

Pursuant to the Airport Noise Prevention and Areas Assistance Act, the Minister of Land, Infrastructure and Transport may designate an airport as a facility requiring countermeasures against noise in case its noise level is 75 or above according to the weighted equivalent continuous noise level (WECPNL). Then, anti-noise measures are implemented in surrounding areas, which are classified in accordance with their noise levels. Construction activities are also restricted in these areas.

Subject to such measures are the airports of Gimpo, Gimhae, Jeju, Yeosu, Ulsan, and Incheon. Gimhae Airport is a military airport but is included in this category as it serves mostly civilian flights. Yangyang and Muan airports are excluded as their level of noise is below the government-set criteria.

Table 7.13 presents statistics on noise countermeasures that have been carried out at airports as well as their future plans. It shows that Gimpo Airport accounts for 84.4% of all measures implemented at airports.

Statistics on detailed projects and plans are shown in Table 7.14. It shows that the largest portion of the budget is spent for installing soundproof and

Table 7.12 Criteria for countermeasures against noise per Article 5 of the Assistance Act

Areas		Noise level (WECPNL)	Countermeasures against noise	Construction restrictions
Class 1		95 or over	• Purchase of land and relocation compensation	• Ban on new construction, addition and improvement
Class 2		90 to 94	• Install soundproof and air conditioning facilities at residences • Install soundproof and air conditioning facilities at schools • Subsidizing TV license fees • Subsidizing electricity fees (schools, low income class) • Projects to support residents	• Ban on new construction, addition and improvement allowed on condition that soundproof facilities be installed
Class 3	A District	85 to 89		• New construction allowed, addition and improvement allowed on condition that soundproof facilities be installed
	B District	80 to 84		
	C District	75 to 79		

Table 7.13 Noise countermeasures performance and future plans by airport (Unit: 1 million won)

Airport	Total	Share	1994-2012 performance			2013 plans	2014-2015 plans
			2012 performance	Cumulative performance	Cumulative performance ratio		
Incheon	2,423	0.5%	251	1,221	50.4	986	216
Gimpo	412,927	84.4%	45,102	263,348	63.8	51,372	98,207
Gimhae	30,131	6.1%	2,340	19,542	64.9	2,554	8,035
Jeju	39,984	8.1%	2,886	27,057	67.7	6,019	6,908
Ulsan	2,913	0.6%	255	1,622	55.7	408	883
Yeosu	1,297	0.3%	54	396	30.5	114	787
Total	489,675	100%	50,888	313,186	64.0	61,453	115,036

Source: Ministry of Land, Infrastructure and Transport, Countermeasures against Aircraft Noise

air conditioning facilities at residences.

Noise countermeasures include the formation and implementation of low-noise flight procedures. Gimpo Airport is applying low-noise flight procedures developed in 2007 (Seoul Regional Aviation Administration, Notice 2007-49). Similar measures are under development for Gimhae and Jeju airports. Incheon International Airport also introduced NADP1[30] and NADP2 as low-noise flight measures in 2008.

30) Noise Abatement Departure Procedure is designed to reduce noise during takeoffs (ICAO Doc 8165).

Table 7.14 Detailed project performance and future plans

(Unit: 1 million won)

Project name		Total		1994-2012 cumulative performance			2013 plans		2014-2015 plans	
		Projects	Project cost	Projects	Project cost	Implementation ratio	Projects	Project cost	Projects	Project cost
Residences	Soundproof facilities	49,447	303,055	33,720	194,026	64.0	5,500	42,005	10,227	67,024
	Air conditioning facilities	10,429	20,858	2,989	3,253	15.6	3,000	4,685	4,440	12,920
Schools	Air conditioning facilities	45	30,801	45	28,502	92.5	1	250	-1	2,049
	Soundproof facilities	45	19,333	43	17,672	91.4	1	250	1	1,411
TV	Interference countermeasures (households)	38,942	1,496	13,274	447	29.9	-	-	25,668	1,049
	License fee (households)	82,836	7,611	26,568	1,362	17.9	28,510	857	27,758	5,392
Electricity fees	Schools	68	1,725	22	549	31.8	23	345	23	831
	Lower income households	1,625	1,216	517	75	6.2	385	59	723	1,082
Projects supporting residents		18	87,849	6	56,597	64.4	6	10,250	6	21,002
Noise measuring network, operation of noise countermeasures committee, noise level surveys		18	15,731	6	10,703	68.0	6	2,752	6	2,276
Total		183,473	489,675	77,190	313,186	48.2	37,432	61,453	68,851	115,036

Source: Ministry of Land, Infrastructure and Transport, Countermeasures against Aircraft Noise

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Chapter
08

International Aviation Cooperation and Tasks Facing the Nation

Section 1

Korea's Status within the International Civil Aviation Organization

1. Korea's International Status

The 38th session of the ICAO Assembly was held in Montreal, Canada for two weeks from September 24 through October 4, 2013 with delegates from roughly 190 member states. At the meeting, Korea was elected to serve on the Council for the fifth consecutive time with the highest-ever support from ICAO member states (156 out of 176 votes cast).

In the 2007 Council election, Korea garnered 124 out of 170 votes cast, thus being ranked fifth among the Part III Council member states. In 2010, it gained 141 out of 161 votes cast, climbing one notch to the fourth. In 2013, among the Part III states, UAE ranked first with Korea and Dominican Republic sharing second. UAE was elected a Council member relatively easily due to its status as the country that chaired the Arab Civil Aviation Association. The Dominican Republic also had an edge over Korea as it belonged to the Latin American Civil Aviation Commissions (22 member states) as well as the 13-member Caribbean Civil Aviation Commission (CARICOM). Table 8.1 shows Korea's ICAO Council election performance since 2001, when it first gained Council membership.

Table 8.1 Korea's performance in ICAO Council elections

Year	Assembly	Part III Council members	Votes gained by Korea	Rank
2001	33rd	12	109	12
2004	35th	13	125	9
2007	36th	13	124	5
2010	37th	13	141	4

In the 38th ICAO Assembly election of the Council held in September 2013, Korea was elected a Council member for the fifth time in a row. The election results are presented in Table 8.2.

Table 8.2 Results of 2013 election of council states at 38th ICAO Assembly

Categories	States elected to ICAO Council (number of votes each state gained)
Part Ⅰ (11 states) (states of chief importance in air transport)	Brazil (160), Germany (159), Japan (155), Australia (152), U.S. (152), China (150), Italy (150), U.K. (146), France (143), Canada (141), Russia (138)
Part Ⅱ (12 states) (states which make the largest provision of facilities for international civil air navigation)	Singapore (163), Egypt (156), Venezuela (155), Saudi Arabia (154), South Africa (154), Portugal (150), Nigeria (149), Norway (149), India (147), Spain (145), Mexico (143), Argentina (137)
Part Ⅲ (13 states) (states ensuring geographic representation)	UAE (158), Korea (156, jointly ranked 2nd), Dominican Republic (156), Burkina Faso (155), Kenya (152), Cameroon (149), Poland (147), Tanzania (147), Libya (141), Chile (140), Nicaragua (137), Bolivia (131), Malaysia (128)

ICAO Council member states can exercise influence on determining international standards related to the global aviation industry. In this regard, Council membership represents the status of a nation in the global aviation community. The Assembly reviews in detail the work of the organization in aviation security, environment, technical, economic, legal, and administrative fields. At the Assembly session, Council members and other states present discussion, working papers, and information papers. At the 2013 Assembly, Korea submitted nine working papers and six information papers and actively participated in discussions on global aviation issues, proving its worth as the world's sixth largest aviation power. The papers presented by Korea were well received by the ICAO Secretariat and most member states. Thus, it is highly likely that the contents of the papers will be adopted as international

standards after being examined by the Air Navigation Commission. Active discussions were held on various aviation issues during the session. It offered an opportunity for Korea to review its status and position with regard to future development of the global aviation industry.

The ICAO Assembly is convened to a meeting and elects Council members every three years. The Council meets every three months. The organization also holds special Council sessions or meetings of delegates of member states whenever the need arises.

Table 8.3 Chief ICAO conferences

Conference name	Main contents	Date and city
• 6th Worldwide Air Transport Conference	Discussions on market approach, consumer protection, and international air transport restrictions	March 18 - 22, 2013, Montreal
• 50th Conference of Directors General of Civil Aviation Asia and Pacific Regions • 3rd Meeting of the Regional Aviation Safety Group • 1st Regional Aviation Security Coordination Forum	Discussions on agenda and issues related to the regional aviation safety, security, transport, and environment	June 27 - July 5, 2013, Bangkok
• 38 ICAO Assembly	Assembly session and election of Council members	September 24 – October 4, 2013, Montreal

ICAO is pursuing strategic objectives designed to ensure aviation safety and security, environmental protection, and continuous development of the air transport industry. In addition to the Assembly session, ICAO also holds three major conferences,[1] ICAO Council meetings, and various committee and commission meetings. About 50 to 60 conferences are held every year at the ICAO headquarters in Canada and regional offices throughout the world. The Assembly session takes place every three years with the participation of about 1,500 delegates from the 191 ICAO member states. At the session the member states review the organization's policy implementation results during the previous three years and establish new plans for the following three years.

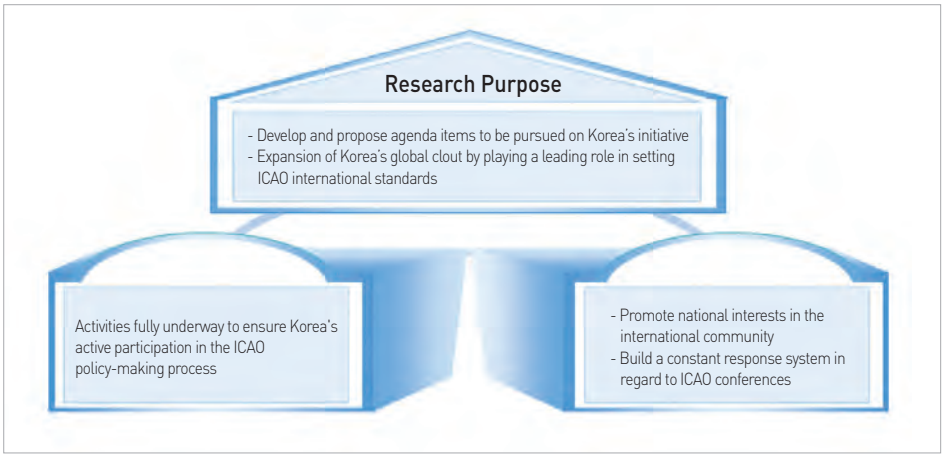
1) ICAO Air Navigation Conference, ICAO High-Level Aviation Security Conference, and ICAO Worldwide Air Transport Conference

2. Efforts to Respond to ICAO Strategic Objectives

In preparation for ICAO conferences, Korea implemented the Research for Responding to ICAO's Strategic Objectives from 2011 through 2013. Through this research Korea developed various agenda items to be presented at ICAO conferences and is preparing analysis reports along with working and information papers. It is also closely monitoring relevant international trends through active participation in ICAO conferences.

- Develop and propose a number of conference agenda items, thus playing a leading role in setting ICAO international standards
- Submit to ICAO mid to long-term measures designed to cope with ICAO's strategic objectives
- Build a system to make constant preparations for ICAO Council meetings and other conferences hosted by the organization

Figure 8.1 Goals of research implemented in response to ICAO strategic objectives



3. Strategy to Implement ICAO Strategic Objectives

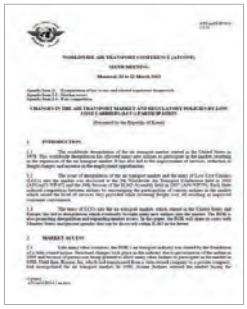
Korea is implementing in-depth research on aviation policy, safety, technology, security and environment. In addition, overseas surveys and

analyses are being conducted to develop more extensive and practical agenda items for ICAO conferences. The research is implemented through various approaches, including information exchanges with prestigious aviation research institutes abroad. For example, organic cooperative systems have been established with aviation authorities and research organizations such as the U.S. Federal Aviation Administration, Civil Aviation Authority of the U.K., Civil Aviation Administration of China, and Japan's Electronic Navigation Research Institute.

Based on the results of the research, the government is seeking to actively participate in ICAO's policy-making process, thereby enhancing the prestige of Korea in the global aviation sector. In addition, it will continue to implement relevant studies, focusing on the need to prevent Korea's national interests from being undermined by newly established or amended international aviation standards, and eventually establish appropriate national strategies in international aviation policy.

Communication efforts should be intensified to increase the international awareness of the growth of the Korean air transport industry as well as

Table 8.4 Korea's responses to ICAO conferences

Categories	6th Worldwide Air Transport Conference	50th Conference of Directors General of Civil Aviation Asia and Pacific Regions	38th ICAO Assembly
Agenda items presented by Korea			
			

Korea's contribution to the global aviation sector through implementation of training programs for developing countries and the supply of relevant IT programs. As it has done in recent years, Korea should continue to submit papers on important issues and actively participate in discussions at ICAO conferences. By so doing, it will be able to play an increasing role in setting international aviation standards.

Research projects need to be expanded to identify various conferences being promoted by ICAO, make proper preparations, analyze conference results, and establish a more effective response system. These efforts will help Korea enhance its role in developing international aviation policies in a manner that suits its status as an ICAO Part III Council member and will help the nation secure a basis for advancing to Part II and Part I.

Section 2

International Cooperation with Developing Countries and Promotion of Overseas Projects

Korea's development of airport infrastructure at global standards began only in 1980 with the opening of the first terminal at Gimpo International Airport. In 2001 the nation opened Incheon International Airport, which has since established itself as one of the world's best airports. The airport now represents Korea as a world-class brand in airport development, which is the core sector in the aviation industry. Based on its experience in building and operating the airport, Korea has implemented a number of international cooperation projects. This section is designed to help formulate a new strategy by examining the past and present of Korea's aviation-related international cooperation projects.

1. Airport Infrastructure Development Plans and Individual Airport Master Plans

On the basis of its experience of formulating Korea's mid to long-term airport development plans and individual airport master plans, The Korea Transport Institute in 2008 implemented a feasibility study for developing

Clark International Airport and a nearby logistics complex in the Philippines. Commissioned by the Korea International Cooperation Agency (KOICA), the feasibility project was carried out jointly with a Korean engineering firm. The study was conducted concerning various aspects of the airport, such as the airside, passenger and cargo terminals, and the planned airport railway connecting the airport with an industrial complex within the free trade zone. Using the airport master plan secured through the KOICA project, the Department of Transportation and Communications of the Philippine prepared a blueprint for its future airport development program. Afterwards, KOTI implemented projects to devise master plans for Khabarovsk Novy Airport in Russia and Mactan-Cebu International Airport in the Philippines. The projects were carried out jointly with Incheon International Airport and a domestic engineering company. Korea is currently seeking to participate in the formulation of mid to long-term airport development plans of the Philippines.

Figure 8.2 Airport industry-related international cooperation projects implemented through aid agencies

Clark International Airport

Mactan-Cebu International Airport

Puerto Princesa International Airport

Joint Participation in Expo

Globally, there are only a limited number of companies that have the capacity to formulate individual airport development plans. Based in advanced countries, these companies specialize in airport development using accumulated expertise and experience. Recently, Korea has been transferring the know-how and expertise related to airport development, planning, and operations to developing countries based on its experience of devising and implementing master plans for 15 airports. Through its international cooperation program, Korea is sharing with developing countries not only previous airport development plans but the latest technical and operational knowledge concerning such areas as information communications, machinery installation, strategy, navigation facilities, rescue and fire prevention, and management. Under its scheme to expand the scope of the international cooperation program, Korea invites foreign officials for training in Korea. It is also promoting joint participation in overseas expositions with developing countries.

2. Diversification of Airport Infrastructure-Related Projects

International cooperation related to airport infrastructure is no longer restricted to planning, operation and construction. Its scope has been expanded to cover the supply and installation of navigation safety devices, which are essential facilities required at airports. In 2005, Korea installed IT infrastructure facilities at Tivat Airport in Montenegro. In the same year, Montenegro officials were invited to Korea for relevant training. Navigation safety facilities developed by Korea have since been supplied to a growing number of countries.

Korea had depended entirely on imports for essential navigation safety equipment until 2004, when Korea Airports Corporation developed the Doppler VHF Omnidirectional Range (DVOR) system. It was an achievement attained through R&D projects aimed at ensuring a smooth supply of

essential components of navigation safety devices, their maintenance and repair, and eventually producing them with domestic technology. The technological prowess of Korea combined with the expertise Korea Airports Corporation obtained through its 30 years of operation of 14 airports in the nation, making it possible to develop such globally competitive navigation safety devices.

Korea has exported the devices to a number of countries, particularly in connection with international cooperation projects over airport infrastructure development.

Table 8.5 Status of Korea's exports of air navigation safety facilities

Categories	Year	Target Airports	Contents	Status
Overseas projects	2009	Saudi Arabia and 5 other countries	DVOR and 3 other types, 10 units	Completed
	2010	Turkey	LLZ and 2 other types, 4 units	Completed
		Sudan	LLZ and 4 other types, 6 units	Underway
	2011	Turkey, Peru	LLZ and 3 other types, 16 units	Underway
	2012	Fiji and two other countries	DVOR and 2 other types, 8 units	Completed
		Turkey, Philippines	LLZ and 4 other types, 43 units	Underway
	2013	Turkey	LLZ and 2 other types, 21 units	Underway
	Joint developers	Mopiens, Youyang, etc.	DVOR/DME, 104 units	Completed
	Total		DVOR, LLZ and 6 other types, 212 units	
Overseas projects: 212 units worth 36.6 billion won to 16 countries Domestic projects: 190 units worth 32.9 billion won to 22 locations				

Note: As of October 2013.

Domestically developed navigation safety devices are now being used in a number of developing countries after being installed as part of airport development projects implemented with aid or loans from the Economic Development Cooperation Fund handled by Korea Exim Bank. A total of 190 units have been installed at domestic airports. By substituting locally developed equipment for pertinent foreign products, the nation has been able to save 32.9 billion won. Beginning with the sale of five DVOR units to the Istanbul Airport in Turkey, Korea has exported a total of 212 units of the air navigation safety devices to 17 countries. Korea is continuing to exert efforts

to explore new markets for the devices by linking them to international cooperation projects.

Need to Ensure Cooperation Among Organizations Related to Overseas Airport Projects

Implementing airport projects overseas requires not merely the knowledge about the airport; it requires knowledge about the practices related to carry out development projects in global markets. Given this, it is necessary to effectively use the know-how both public and private enterprises have acquired in relation to international development projects. It is essential to create new capabilities based on accumulated knowledge as well as through cooperation and competition among various organizations.

In order to turn overseas airport development projects into high value-added ones, the government should try to ensure the sharing and creation of pertinent knowledge. Effectively implementing overseas projects requires not just state policy support but the promotion of smooth communication and cooperation among relevant organizations.

Table 8.6 ODA projects implemented in the airport infrastructure development sector

Airports	Support agency	Project year	Project nature
Tivat International Airport (Montenegro)	KOICA	2004	Improvement of airport facilities (FIDS)
Laguindingan Airport	Korea Exim Bank	1996 (1st), 2004 (2nd)	Airport development
Busuanga B. Reyes Airport	KOICA	2007	Airport development
Clark International Airport	KOICA	2008	Master plan and feasibility studies (alternative main airport)
Mactan-Cebu International Airport	KOICA	2010	Master plan
Puerto Princesa International Airport	Korea Exim Bank	2013	Airport development (construction)
Philippines Mid to Long-Term Airport Development Plan	KOICA	2014	Development of national airport system

Based on experience in developing and operating domestic airports, Korea can dispel concerns about its capability to implement overseas airport

projects. It is making steady progress in this sector through continuous international cooperation programs.

ICAO predicts continuous growth in global air traffic, which will lead to the expansion and construction of airport facilities. Korea will have a growing number of opportunities to take part in airport infrastructure projects overseas through international cooperation programs. Utilizing these opportunities, the relevant Korean organizations should go beyond just devising feasibility or master plans for foreign airports and instead actively seek to participate in the actual operation of airports or related investment projects through multifaceted international cooperation.

International aviation infrastructure projects differ in their extent of risks depending on aid recipient areas, nations, and political environment. Ensuring a long-term success in various projects under these circumstances requires efforts to increase manpower specializing in airport infrastructure development and related projects (finance) as well as the establishment of databases related to overseas projects. These efforts will contribute to transforming overseas airport development projects into high value-added enterprises. Diversification of foreign airport development projects cannot be achieved with endeavors of just a few organizations. Such projects should be promoted based on state policy support as well as cooperation among all sectors of society. If implemented in such a manner, aviation infrastructure development can be considered a new growth engine for the national economy.

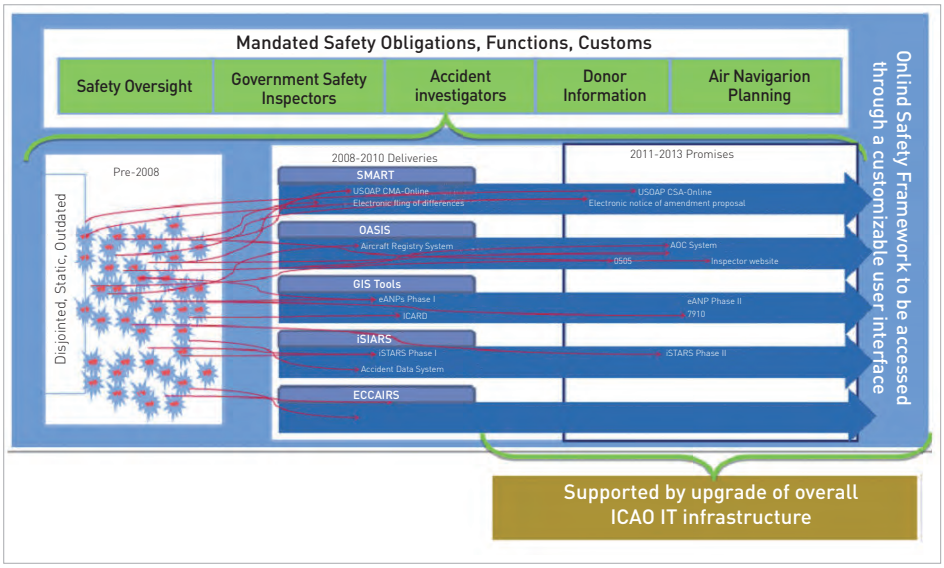
Section 3

Continuous International Cooperation and Tasks for Enhancing Aviation Safety

1. Joint Research on Aviation Safety System with ICAO Air Navigation Bureau

For global aviation safety management, ICAO is implementing the Global Aviation Safety Plan, the Universal Safety Oversight Audit Program (USOAP) and the National Aviation Safety Program. ICAO needs to secure correct data for the establishment of safe and systematic air transport policies. In order to hammer out agreements among states, it needs to effectively collect aviation safety and navigation data, including those on each member state's implementation of about 10,000 standards and recommended practices (SARP). ICAO classified aviation safety-related data into the categories of SARP, aircraft operations, and geo-referencing data. It then began developing the systems necessary for each category: SARP Management and Reporting Tools (SMART), Online Aircraft Safety Information Service, and GIS-related tools. Ensuring the success of these systems is very important as it is directly related to the promotion of global aviation safety.

Figure 8.3 Plan for building a safety-related IT system



Source: Yuri Fattah, Electronic Safety Tools, Delivering Safety Data to those Who Need It, ICAO press release, September 2010.

Since March 2011, Korea has been participating in the SMART project, based on its experience and technological capabilities related to the development of its aviation safety IT system called SARP Management and Implementation System (SMIS). This represents aviation safety-related cooperation in the IT sector among ICAO, the Ministry of Land, Transport and Maritime Affairs (MLTM), and the Korea Transport Institute (KOTI). The cooperation project was initiated at the 37th Assembly session held in September 2010.

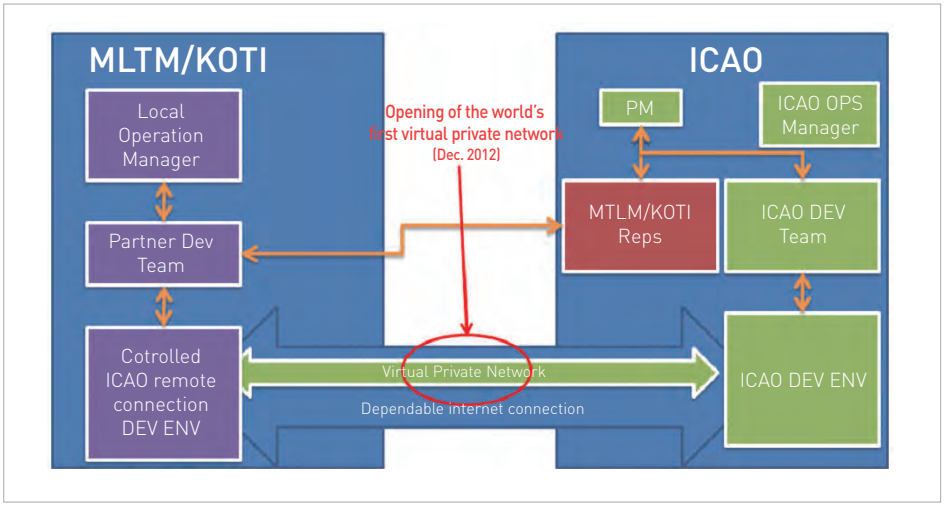
The ministry then sought the help of KOTI, the nation's most prestigious research institute in the field of aviation safety. As an organization charged with the mission of supporting the government with its research activities, KOTI helped the ministry by implementing preliminary studies related to the SMART project in 2011. Beginning in 2012, the institute actively implemented ministry-commissioned research tasks, including one titled A Project to Support the Establishment of an ICAO Global Aviation Safety Information System.

These efforts led to the signing of an MOU between the ICAO secretary-general and the ministry's aviation policy chief in May 2012 for bilateral cooperation on creating the ICAO computing system. At the same time, an annex on SMART cooperation was signed by the ICAO Air Navigation Bureau, the ministry's Aviation Policy Department, and KOTI.

The procedures can be summed up as follows:

- October 2010: 37th ICAO Assembly discusses Korea's support for ICAO IT system development
- March 2011: Working-level negotiations among ICAO, MLTM and KOTI
- June 2011: KOTI officially requested to support the development of SMART system
- January 2012: Opening of KOTI-ICAO virtual private network
- May 2012: MOU signed between ICAO and MLTM (KOTI participates in annex signing)
- September 2012: Start of operation of some modules (Compliance Checklist offline)
- October 2012: Start of team foundation server operation (opening of KOTI-ICAO two-way server), some modules (PnS Tool) slated for pilot operation

Figure 8.4 Long-range cooperation model



The cooperation system involving ICAO, MLTM and KOTI led to the promotion of a long-term project for enhancement of global air transport safety. In this process ICAO and KOTI began operating the team foundation server using a virtual private network for the first time in the world. This is an example of the fundamental and physical cooperation system formed between the two sides. The experience and human network Korea has gained through its cooperation with ICAO will surely help the nation contribute greatly to enhancing global aviation safety.

Initiated by MLTM and supported by KOTI, this cooperation project has great significance as it represents Korea's participation in an ICAO program to build a crucial IT system. It is expected to generate various effects as illustrated in Figure 8.5. For effective generation of these effects, both sides are working diligently as shown in the signing of MOU between ICAO and MLTM and the establishment of a team foundation server using the world's first two-way virtual private network. Consequently, SMART system modules developed by Korea have begun operation with a succession of other modules expected to follow suit in the near future. These achievements will no doubt

Figure 8.5 Expected effects of Aviation Safety IT project

help drastically enhance global aviation safety.

2. Technological Cooperation with Japan's Electronic Navigation Research Institute

The improvement of safety and efficiency is becoming increasingly important in the air transport sector. Addressing any problem related to the safety and efficiency of aviation requires cooperation both at home and abroad. Because of this need, international collaborative research is on the rise. KOTI is also expanding research cooperation with prominent foreign institutes such as the Electronic Navigation Research Institute of Japan and the National Aerospace Laboratory of the Netherlands.

Japan's Electronic Navigation Research Institute (ENRI) is the only institute in Japan conducting research on various areas related to air traffic systems, such as air traffic management, communication, navigation and surveillance. Of late, it is participating in projects to facilitate air traffic safety and environmental preservation. In particular, the institute is supporting

Figure 8.6 International cooperation leads to enhancement of safety and efficiency

the government by placing its research emphasis on the topics included in the Collaborative Actions for Renovation of Air Traffic Systems (CARATS) program, which has been formulated by the Ministry of Land, Infrastructure, Transport and Tourism for smooth advancement of the air traffic systems in Japan. Its main research areas are trajectory-based operation, ATC support system and safety assessment of airspace, aviation traffic control and navigation support using satellite systems, and aircraft surveillance and communications technologies.

ENRI has accumulated considerable expertise and know-how concerning airspace surveillance through its long years of research on the related methodology and techniques. Thus, it is now implementing airspace safety evaluation for the ICAO Regional Monitoring Agency (RMA) and the En-Route Monitoring Agency (EMA).

In 2011, KOTI signed an MOU with ENRI, agreeing to conduct collaborative research and increase bilateral cooperation. Based on the MOU, the two organizations jointly implemented training and research verification projects in relation to airspace safety assessment techniques. The two sides have recently agreed to carry out joint studies for the application of "mixed approach procedure," a technique devised by Japan. They are also seeking ways to expand mid to long-term bilateral cooperation.

Developed as part of the CARATS program, the mixed approach procedure has been presented as a way to expedite Performance Based Navigation (PBN) and address the problem of crowdedness in terminal areas. Its initial concept is based on the idea of "allowing planes approaching the same runway through different access procedures (for example, one plane uses an Instrument Landing System (ILS) approach procedure while another adopts an Required Navigation Performance Authorization Required (RNP AR) approach procedure) to approach the runway simultaneously at certain intervals by adopting the optimum procedure for each aircraft, instead of requiring the use of the same approach procedure or asking one plane to wait until the other competes the approach." Its concept has not yet been clearly defined. Through joint research, KOTI is carrying to determine the concept

and prepare measures for its implementation. Conducting the research requires risk analysis concerning the mixed approach procedure. Currently, KOTI is to implement studies on hazard identification and risk analysis methods.

KOTI is also seeking to expand research cooperation with National Aerospace Laboratory (NLR) of the Netherlands. International cooperation with such prestigious institutions as ENRI and NLR will make it possible for KOTI to cope with changes in international air traffic systems expeditiously. It will also help lay the groundwork for proactively conducting research on new concepts, thus securing a leading position in the relevant international community.

3. International Cooperation through Knowledge Sharing with Developing Countries

Since May 2013, KOTI has been promoting a knowledge sharing program in the aviation industry sector, targeting developing countries. This program is not based on the traditional method of transferring technologies through relevant international cooperative agencies. Instead, it is designed to directly share knowledge concerning airport infrastructure and aviation policies with transport and air traffic experts of developing countries. This program aims to help developing countries develop the capabilities necessary for implementing airport development projects, from planning to operation.

Joint Seminar on KSP: Knowledge Sharing with Nigeria, the Biggest Economy in West Africa

Incheon International Airport has established itself as a top global brand representing Korea. This achievement is attributable to the airport's endeavor to upgrade its service level and implementation of comprehensive plans to develop the surrounding area into logistics, commercial and entertainment districts. In Nigeria, the Federal Ministry of Aviation has formulated a long-

term plan for the Aerotropolis[2] project, which represents a scheme to build airport-centered economic zones.

In May 2013, KOTI and the Nigerian Aviation Ministry held a joint seminar at the ministry headquarters in Abuja to discuss the prospects of implementing a bilateral knowledge sharing program. At the seminar, KOTI explained Korea's airport development projects, focusing on planning methodology and experience related to the establishment of plans and policies. There were in-depth discussions on the characteristics of mid to long-term airport development plans as well as development policies related to airport functions. KOTI also briefed the Nigerian participants on the successful construction and performance of Incheon International Airport.

Various countries were already participating in various transport infrastructure projects underway in Africa as part of aid programs. In regard to Korea's role, KOTI proposed implementing capacity building and knowledge sharing programs. It expressed its intention to share with Nigeria the knowledge and know-how needed for operating traffic facilities after their installation.

Mr. Hassam Musa, Director General for air traffic at the Nigerian Federal Ministry of Aviation, participated in the Leaders in Urban Transport Planning (LUTP) program KOTI hosted in conjunction with the Ministry of Land, Infrastructure and Transport and the World Bank on September 13, 2013. Musa underwent a training course on airport infrastructure development and aviation safety.

Aviation Infrastructure Development: Knowledge Sharing Program[3] Based on Korea's Experience in Building Infrastructure

KSP training for high-ranking transport officials from developing countries

2) Airport-centered development of Nigeria's four main airport areas: Lagos, Abuja, Kano and Port Harcourt.

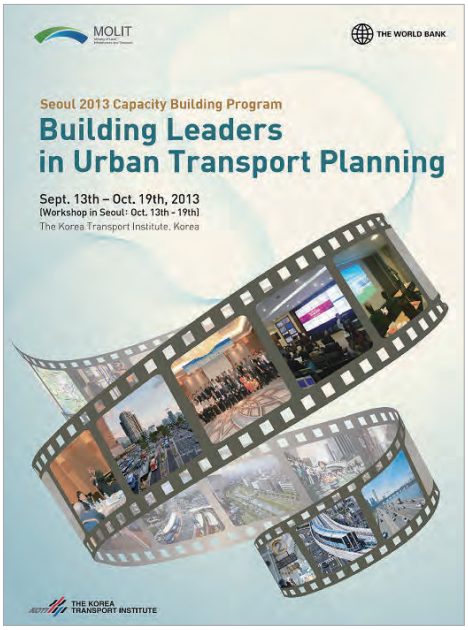
3) A program jointly hosted by the Korea Research Institute for Human Settlements and KOTI with support by MOLIT.

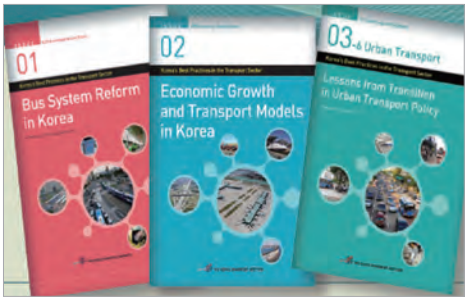
Figure 8.7 KOTI-Nigeria Aviation Ministry Joint Seminar on May 2013

KOTI President KIM Gyeong Chul (right) delivers KOTI KSP books to Nigeria Aviation Minister George A. Ossi (Permanent Secretary) (left).

Seminar participants pose for a photo.

Figure 8.8 KOTI LUTP Knowledge Sharing Program and KSP publications





▲ Transport-related KSP books published by KOTI.

◀ Leaders in Urban Transport Planning (LUTP) Program (2013) jointly hosted by MOLIT, KOTI and the World Bank.

in Asia was implemented twice in September and October 2013 under the auspices of MOLIT. The training courses included an introduction to the KSP program for the aviation sector; briefs on the timeline of airport development in Korea, the related planning system, and aviation safety software structure.

The aviation safety program developed by MOLIT is now in use in

Table 8.7 Infrastructure training for high-level officials

Classification	High-level infrastructure development training
Attendees	High-level officials (director general or higher)
Purpose	Overseas construction market exploration
Contents	Integrated contents about overall infrastructure (transport, water resources, etc.)
Layout	Lectures (40%), site visits (60%)
Period	About a week

Table 8.8 2013 knowledge sharing projects

Period		Area	Participating countries
1st	September 9 (Mon.) - 13 (Fri.), 2013	Infrastructure/ transport	8 officials from 5 countries: Mongolia, Myanmar, Cambodia, Pakistan, Philippines
2nd	September 30 (Mon.) - October 5 (Fri.), 2013	Infrastructure/ transport	6 officials from 5 countries: Nigeria, Myanmar, Kuwait, Thailand, Algeria
3rd	October 21 (Mon.) - October 25 (Fri.), 2013	Infrastructure	7 officials from 7 countries: Nigeria, Myanmar, Azerbaijan, Cambodia, Kuwait, Vietnam, Pakistan
		Transport	4 officials from 4 countries: Azerbaijan, Cambodia, Thailand, Bangladesh
4th	November 11 (Monday) - November 15 (Fri.), 2013	Infrastructure	4 officials from 3 countries: Malaysia, Myanmar, Vietnam
		Transport	7 officials from 6 countries: Nigeria, Malaysia, Mongolia, Indonesia, Bangladesh, Thailand

over 50 countries. It is one of the essential elements that helped Korea receive top rating scores in the ICAO safety audit. The program has been supplied to developing countries since 2007 for use by their aviation safety authorities and is designed to facilitate the reporting process related to the implementation of ICAO standards and recommended practices as well as measures taken to make up for deficiencies. By supplying the program to developing countries and sharing the knowledge for its use, Korea has contributed significantly to improving their aviation safety levels. The KSP project helped shed light on such efforts exerted by Korea to provide developing countries with information necessary for enhancing their aviation safety, thereby ensuring a safer global aviation environment.

The training courses include a seminar held by groups as well as discussion sessions on technological matters that could be shared among the participants.

Korea's aviation industry is gaining global recognition for its continuous positive performance. In particular, its superb airport services and operations are having positive impact on the worldwide air traffic industry. The knowledge sharing program based on Korea's achievements and experience offers a good chance for the nation to further enhance its status in the international aviation community.

Aviation Safety: Evolution from a Top Scorer in Audit to a Leader in Knowledge Sharing

In the 2008 ICAO aviation safety audit, Korea received a rating score of 98.89%, the highest in the world. Korea's stellar performance in this category may be attributable to SARP Management Implementation System/Safety Oversight Management System (SMIS/SOMS), which has been continuously upgraded since 2006. Korea is implementing training programs for aviation safety officials from developing countries in relation to this program. The training programs are organized by KOICA, MOLIT's Flight Standards Division, and KOTI.

Table 8.9 Training in SMIS/SOMS aviation safety IT systems and international supply activities

Period	Participating countries	Trainees
2012	Bhutan, Cambodia, Indonesia, Laos, Mongolia, Nepal, Papua New Guinea, Philippines, Sri Lanka, Thailand, Oman, Samoa (12 countries)	18
2013	Bangladesh, Cambodia, Laos, Philippines, Estonia, Benin, Burkina Faso, Ghana, Nigeria, Seychelles, Tanzania, Bahamas, Jordan, Lebanon (15 countries)	15
Period	Provided to (2013)	Countries
September 24 - October 4, 2013	Venezuela, Colombia, Kiribati, Namibia, Libya, Uganda, Kenya	7

KOTI is promoting a project to continuously upgrade and improve the SMIS/SOMS program including the preparation of a new version. So far, the 3.5 version of SMIS and the 2.0 version of SOMS have been supplied to about 60 countries. Now, the program is being revised to make up for deficiencies and to reduce user inconvenience to the maximum extent. Further improvement is to be made based on feedback from users, including

operators in foreign countries.

Table 8.10 Overseas supply of SMIS/SOMS

Number	Country	Region	Date	Version
1	Kiribati	Asia-Pacific Region (29 countries)	October 2013 (1)	2012 version
2	Mongolia		June 2012 (2)	2012 version
3	Thailand		June 2012 (3)	2012 version
4	Cambodia		June 2012 (4)	2012 version
5	Indonesia		June 2012 (5)	2012 version
6	Laos		June 2012 (6)	2012 version
7	Philippines		June 2012 (7)	2012 version
8	Nepal		June 2012 (8)	2012 version
9	Sri Lanka		June 2012 (9)	2012 version
10	Maldives		June 2012 (10)	2012 version
11	Papua New Guinea		June 2012 (11)	2012 version
12	Bhutan		June 2012 (12)	2012 version
13	Myanmar		September 2012 (13)	2012 version
14	Brunei		February 2013 (14)	2012 version
15	Bangladesh		September 2012 (15)	2012 version
16	Fiji		December 2012 (16)	2012 version
17	Pakistan		December 2012 (17)	2012 version
18	Solomon Islands		January 2013 (18)	2012 version
19	Marshall Islands		January 2013 (19)	2012 version
20	Vanuatu		January 2013 (20)	2012 version
21	Kyrgyzstan		February 2013 (21)	2012 version
22	Tonga		February 2013 (22)	2012 version
23	Taiwan		April 2013 (23)	2012 version
24	Australia		November 2010	2010 version
25	Malaysia		September 2010	2010 version
26	India		September 2010	2010 version
27	Samoa		September 2010	2010 version
28	Hong Kong		September 2010	2010 version
29	Vietnam		September 2010	2010 version
30	Poland	Europe (4 countries)	November 2010	2010 version
31	Romania		November 2010	2010 version
32	Montenegro		March 2011	2010 version
33	Estonia		June 2013 (24)	2012 version
34	Colombia	South & Central America (7 countries)	October 2013 (25)	2013 version
35	Venezuela		October 2013 (26)	2013 version
36	Bahamas		June 2013 (27)	2012 version
37	Dominican Republic		October 2013 (28)	2013 version
38	Argentina		December 2010	2010 version
39	Bolivia		February 2011	2010 version
40	Curacao		January 2014 (29)	2013 version

Table 8.10 Overseas supply of SMIS/SOMS (continued)

Number	Country	Region	Date	Version
41	Namibia	Africa (18 countries)	October 2013 (30)	2013 version
42	Egypt		December 2010	2010 version
43	Nigeria		June 2013 (31)	2012 version
44	Tanzania		June 2013 (32)	2012 version
45	Seychelles		June 2013 (33)	2012 version
46	Ghana		June 2013 (34)	2012 version
47	Benin		June 2013 (35)	2012 version
48	Burkina Faso		June 2013 (36)	2012 version
49	Kenya		October 2013 (37)	2013 version
50	Burundi		September 2013 (38)	2012 version
51	Cameroon		January 2011	2010 version
52	Uganda		November 2013 (39)	2013 version
53	Cape Verde		December 2010	2010 version
54	Madagascar		December 2010	2010 version
55	Zambia		January 2011	2010 version
56	Malawi		February 2011	2010 version
57	Rwanda		February 2011	2010 version
58	Uganda		December 2011	2010 version
59	Libya	Middle East (6 countries)	October 2013 (40)	2013 version
60	Jordan		June 2013 (41)	2012 version
61	Lebanon		June 2013 (42)	2012 version
62	Yemen		October 2013 (43)	2013 version
63	Iraq		October 2013 (44)	2013 version
64	Oman		June 2012 (45)	2012 version

Note: As of January 2014.

At the Safety Electronics Tools (SET) 2013, a pre-Assembly event of the 38th ICAO Assembly session held in September 2013, KOTI supported MOLIT by promoting the SMIS/SOMS program. It also directly supplied the program to countries that desired implementation.

The project to improve the performance and functions of the SMIS/SOMS program is planned to be pursued continuously. Its new version will be provided by the Korea Aviation IT Support Team to countries operating previous versions. These activities will help raise Korea's status in the international aviation sector and facilitate the sharing of relevant knowledge.

Table 8.11 Korea's international cooperation projects in the aviation sector

Airports	Support agency	Project year	Project nature
Tivat International Airport (Montenegro)	KOICA	2004	Airport facility improvement (FIDS)
Laguindingan Airport	Korea Exim Bank	1996 (1st) 2004 (2nd)	Airport development (construction completed February 2013)
Busuanga Airport	KOICA	2007	Airport development
Clark International Airport	KOICA	2008	Master plan and feasibility studies (alternative main airport)
Korea-Philippines International Aviation Cooperation Seminar	KOICA/KOTI	2008	Department of Transportation and Communications/MLTM/ KOTI joint seminar
Mactan-Cebu International Airport	KOICA	2010	Master plan
ICAO SMART (EFOD) joint R&D (1st year)	KOTI	2011	Joint R&D
Aviation Safety Training Program for Developing Countries	KOICA	2012	Aviation safety IT SMIS/SOMS training
ICAO SMART joint R&D (2nd year)	MLTM	2011	Joint R&D
Puerto Princesa International Airport	Korea Exim Bank	2013	Airport development (construction)
Aviation Safety Training Program for Developing Countries	KOICA	2013	Aviation safety IT SMIS/SOMS training
Aviation safety IT On-Site Supply (Montreal, Canada)	MOLIT/KOTI	2013	Aviation safety IT supply and installation
KSP Seminar for 4 African Countries	KOTI	2013	Knowledge sharing seminar on airport industry development
ICAO SMART Joint R&D (3rd year)	MLTM/KOTI	2011	Joint R&D
Research on Mid to Long-Term Development of Airports in the Philippines	KOICA	2014	Development of national airport system

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KOTI Knowledge Sharing Reports

Recently, developing countries have shown interest in Korea's transport policy establishment and infrastructure construction experience on the premise that those changes have enabled the nation to promote economic growth. Against this backdrop, Korea Transport Institute (KOTI) publishes a series of Knowledge Sharing Reports series regarding Korea's transport system and policy accomplishments in the fields of roadway, railway, aviation, logistics, and public transport.

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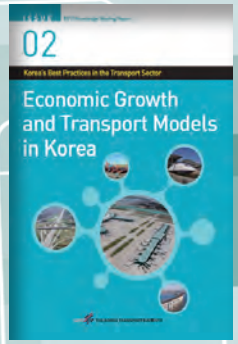

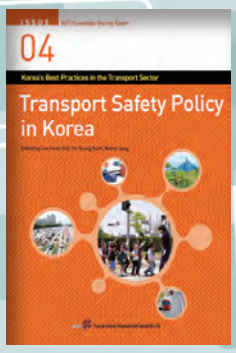

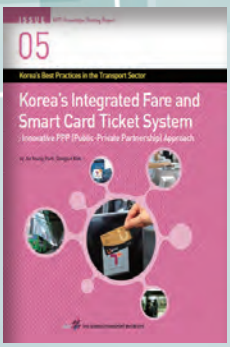

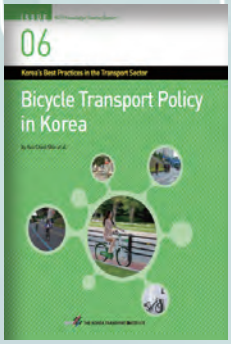

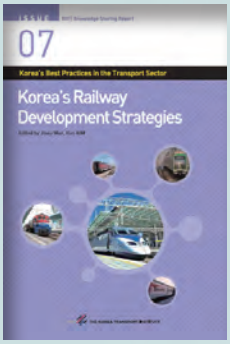

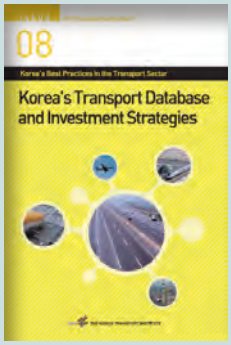

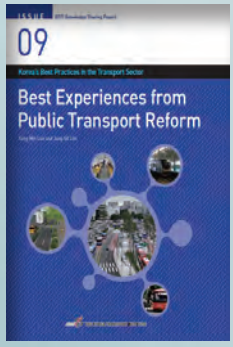

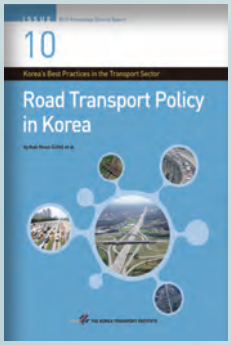

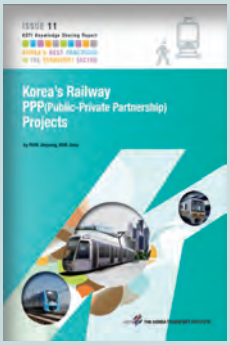

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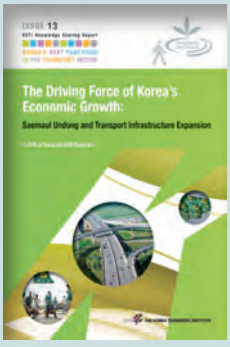

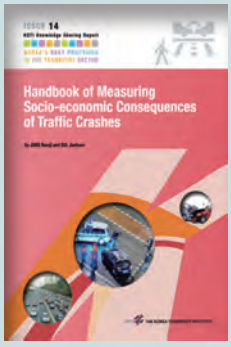

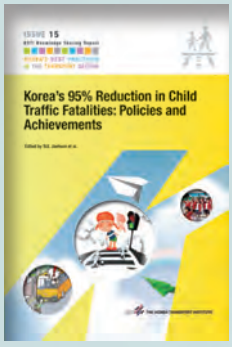

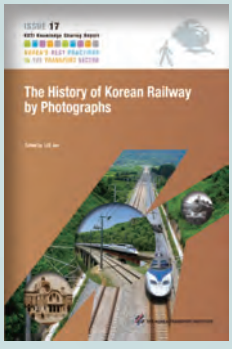

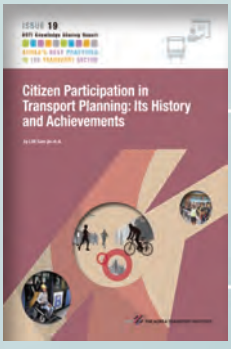

Korea's Aviation Policies

The Korea Transport Institute (KOTI) is a comprehensive research institute specializing in national transport policies. As such, it has carried out numerous studies on transport policies and technologies for the Korean government.

Based on this experience and related expertise, KOTI has launched a research and publication series entitled "Knowledge Sharing Report: Korea's Best Practices in the Transport Sector." The project is designed to share with developing countries lessons learned and implications experienced by Korea in implementing its transport policies. The 20th output of this project deals with the theme of "Korea's Aviation Policies."

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