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A KOREA AIRPORT SYSTEM : ITS PROBLEM DIAGNOSIS AND FUTURE PERSPECTIVES

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Discussions are given to Korea air transport market and its intrinsic problems related to airport spatial distribution and facility capacities. Regional development impacts and demand forecasts are major variables for identifying a future direction for restructuring air transport market in Korea. A brief introduction is also given to the New Seoul International Airport(NSIA) that is expected to lead domestic and the North East Asia air transport market.

1. Introduction

Air transportation of Korea, after hitting the regular growth track in the 1970's, has registered tremendous volumes of traffic since the 1980's. It is still increasing at a rate which is one of the highest in the world. Such an increasing trend will almost certainly continue. ICAO, IATA, etc. view that the world aviation market in the 2000's will be led by the Asian/Pacific Region, especially, Northeast Asia.

Currently in Korea, air transportation is available at 11 cities including Kimpo, Kimhae, and Cheju. As is well known, however, the facilities of the local airports in Korea are by far below par both in quality and quantity, and yet they are mostly shared with the military. Even with the international airports in Korea, the service level is steadily deteriorating, as the aviation demand is rapidly increasing to the saturation point of their capacities.

This difficulty, of course, stems largely from the explosive demand increase. In the 1980's, as the national prestige enhanced, the number of international passengers continued to increase ahead of the forecasted level by 5 to 6 years, and that of domestic passengers increased by upwards of 20% in annual average during the last decade, what with improved income level of the population and inadequacies of land transportation networks.

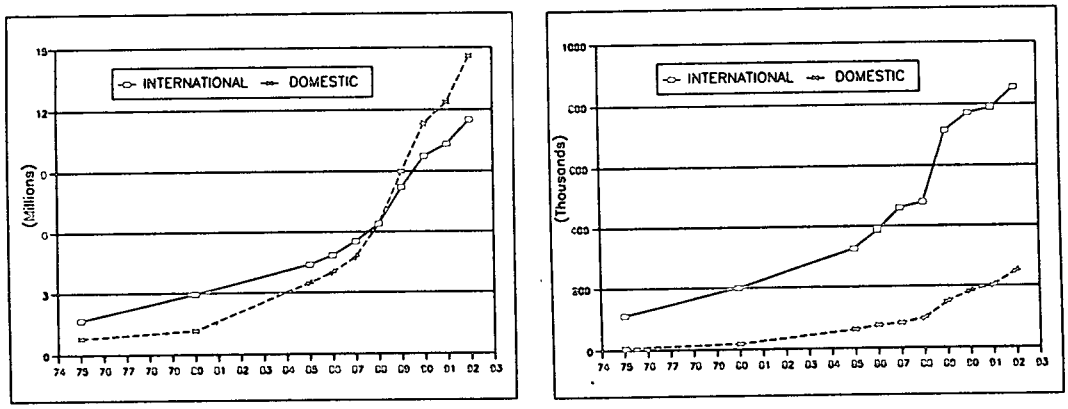
Apart from these external factors, it cannot be overlooked that there was a mistake in the aviation policy that has failed to make timely investments in necessary facilities. The nation experienced oil crisis in the late 1970's to early 1980's and, in its aftermath, many of the local airports were closed down. Soon after this, however, the upswing of the business cycle came around, and the resultant aviation demand increase suddenly brought the local airports back to life. This course of developments made timely investment difficult and, in recent years, the problems with the local airports became quite acute.

2. Past records and future prospects of air transportation

2.1 Past records

2.1.1 Increasing Trend of aviation demand

The aviation demand increase in Korea was gradual up to the 1970's, but it began to pick up speed in the 1980's(see Figure 1). For the international lines, the meassure of liberalizing overseas travels and the Seoul Olympic Games and, for the domestic lines, the demand spill over from the rail and highway networks and the increase of the income levels of the population, provided a major impetus for expansion of the volume of air transportation. The pattern of increase roughly coincided with the curve of the nation's economic growth.



Passenger Freight

Figure 1. Aviation Demand

The transportation records of the international lines may arguably be said to be the actual demand. With the domestic lines, however, the records are nearer to the supply rather than to the demand. Up until the 1970's when the demand was so insignificant and the air fare structure had many absurdities, the demand was virtually limited by the supply. The records for the 1980's, too, which reflect the relatively low fare rates and include substantial demand diverted from the land transportation system for its low service level, can hardly be said to represent the actual aviation demand. Another problem is the fact that medium/long-term aviation demand forecasts are often reduced to a far cry from reality due to unforeseeable factors caused by the instability of the interregional transportation system in terms of fare, travel time, etc.

Incidentally, the load factor, representing the boarding rate to seat supply, remains approximately 55% for the international lines. For the domestic lines, however, it is as high as 75%, and is expected to rise even higher. This is because the number of flights supplied falls by far short of the rapidly increasing aviation demand, especially, with lines linked to local airports. Probably also to blame for this is the passive attitude in their operation strategies of the airline companies caused by the instability of the domestic aviation market and absurdities of the existing air fare structure and their policy to maintain as simple an aircraft mix as possible.

2.1.2 Demand Distribution

In the international air transportation, the weight Kimpo Airport carries is overwhelming(see Table 1). The airport has handled more than 85% of the total demand for passenger transportation, and the share is increasing of late. This is because all new international lines to and from Korea are being opened mainly through this airport.

Table 1. Distribution of International Passengers among Airports

(in thousand persons, %)

Year	'76	'80	'85	'90
Kimpo	1,734 (86)	2,484 (85)	3,776 (86)	8,466 (88)
Cheju	21 (1)	25 (1)	83 (2)	230 (2)
Kimhae	259 (13)	413 (14)	524 (12)	950 (10)
Total	2,014 (100)	2,922 (100)	4,383 (100)	9,626 (100)

Note : The figures inside the parentheses represent market shares.

With cargo transportation, the market share of Kimpo Airport is even greater (more than 95%).

With domestic passengers, while Kimpo Airport leads the other airports, a triumvirate is maintained along with Cheju and kimhae Airports, but the shares of the local airports are increasing fast. This is also true with air cargo.

Table 2. Distribution of Domestic Passengers among Airports

(in thousand persons, %)

Year	'76	'80	'85	'90
Kimpo	567 (36)	1,066 (36)	2,520 (36)	8,375 (38)
Cheju	461 (29)	881 (30)	1,957 (28)	5,579 (25)
Kimhae	436 (28)	844 (28)	1,689 (25)	4,738 (21)
Others	115 (7)	171 (6)	770 (11)	3,428 (16)
Total	1,574 (100)	2,962 (100)	6,936 (100)	22,120 (100)

Note : The figures inside the parentheses represent market shares.

As of 1993, the 14 airports throughout the country were linked together by 22 lines(on one-way basis) with Seoul and Cheju as the two poles assigned with 12 and 8 line respectively. Of these, four lines : Seoul-Pusan ; Seoul-Cheju ; Seoul-Kwangju : and Cheju-Pusan may be called the artery lines, accounting for 70% of the domestic aviation market. The market share has been diminishing of late as the local airports are being resuscitated.

When Seoul-Pusan and Honam High Speed Rails become operational, Seoul-Pusan and Seoul-Kwangju lines will lose substantial portions of their customers to the former, while lines linked to Cheju which will be ree from the impact of the high speed rails are expected to gain their relative weight.

2.2 Prospect of Aviation Demand

Experts view that, but for fundamental changes in the internal and external conditions of the aviation markets, the demand in Korea will continue to grow, and specialized international agencies such as ICAC and IATA, etc. also have expressed similar optimistic views.

The following is a summary of the propects of the passenger aviation demand as are included in various feasibility studies of development of new airports and local airports that have been done to date.

Table 3. Prospect of Passenger Aviation Demand

(in thousand persons)

Year	1990	1995	2000	2005	2010
International	9,626	15,667	24,589	34,000	47,011
Domestic	11,064	20,651	30,883	34,964	44,054

Note : The above figures for 2005 and 2010 assume commissioning of Seoul-Pusan High Speed Rail in 2001.

Source : Aviation Bureau, Ministry of Tranportation

According to these prospects, up to the

year of 2000, the demand will increase by 10% for international lines and 11% for domestic lines in annual average respectively, but then, the increase rate for the domestic lines will begin to decline.

With completion of New Seoul International Airport(NSIA)[1] on Yongjong Island in 1999, the air transportation services in the Seoul Metropolitan area will enter an era of a dual airport system. The prospect of the passenger aviation demand of the Seoul Metropolitan area is as follows.

Table 4. Prospect of Passenger Aviation Demand of Seoul Metropolitan Area

(in thousand persons)

Year		1990	1995	2000	2005	2010
Kimpo	International	8,446	13,098	8,055	7,864	5,558
	Domestic	8,375	15,815	21,377	23,107	28,763
	subtotal	16,821	28,913	29,432	30,971	34,294
NSIA	International	–	–	12,411	20,296	33,189
	Domestic	–	–	2,181	2,256	2,867
	subtotal	–	–	14,592	22,552	36,056
Total		16,821	28,913	44,024	53,523	70,350

Source : Aviation Bureau, Ministry of Tranportation

According to the plans so far finalized, Kimpo Airport will be oriented to specialization in domestic lines, and NSIA in international. It is also expected that NSIA will be a hub airport and eventually be the largest in the region by 2020.

As completion of NSIA originally scheduled for 1997 has been postponed to 1999, Kimpo Airport will definitely be overloaded until then, making it imperative to expand its facilities and readjust its operation plan to meet the need from 1996, the expected point in time of saturation of its capacity, on through completion of NSIA.

Frequencies of aircraft operations, the most important variable with respect to the saturation of the capacity of Kimpo Airport, are forecasted as follows.

Table 5. Frequencies of Aircraft Operation as Kimpo Airport

Year	1990	1995	2000	2005	2010
International	47,844	76,374	48,340	39,844	32,841
Domestic	65,398	12,173	155,513	155,000	190,367
Total	113,242	197,447	203,853	194,844	223,208

Note : Inclusive of all types of aircraft, i.e., passenger carriers, cargo carriers, and others.

Source : Aviation Bureau, Ministry of Tranportation

The aircraft in operation becoming ever larger in size, the runways of Kimpo Airport will reach its saturation point before NSIA is complete. To solve this problem, a number of measures may be considered such as expanding the time zone of aircraft operation and modernization of air traffic control procedures, but none of them are simple for implementation.

3. Current status and problems of Korean aviation facilities

3.1 Current Status of Airport Facilities

At present, a total of 14 airports is in operation in Korea, and 2 new airports, Chongju Airport and NSIA, are under construction.

The 3 international airports(Kimpo, Cheju and Kimhae), Ulsan and Yosu Airports are civilian airports, and the rest are all being shared with the military. Kimpo Airport is the only full size international airport in Korea. Kimhae and Cheju Airoprts are "minimal" international airports which are lacking both in quantity and quality of most facilities. Both of these airports have serious physical constraints for facility expansion. This is also true with Kimpo Airport.

Most of local airports have started out with existing military air base facilities by hurriedly adding to them minimum facilities required for civilian aviation. Even

1) The Airport was initially called New Seoul Metropolitan Airport, but the Korean Government Authorities have begun to use this new name.

with these substandard facilities, their capacities available for civilian use are solely dependent upon the military needs. Further, the runways of Yosu, Sokcho, and Mokop Airports do not match some of the aircraft types on hand at Korean airline companies.

3.2 Capacities

Critical to airport capacity are the area of the airport site and the capacity of the runway, constdruction of which accounts for the bulk of the total cost of airport construction. Unlike the other facilities which allow considerable flexibility if only prepared for a lower service level, the runway capacity is a highly rigid element as far as its size is concerned. This is because aircraft is subjected to strict air traffic control. Bottlenecks of airport capacity are mostly related to the runway capacity.

On the other hand, airport, an aggregate of various subsystems, must have its various different subsystems balanced in capacity among them and, together, they must be able to provide a reasonable level of service.

Most of Korean airports have serious unbalance among their staple facility items. Kimpo Airport, which is expected to reach the saturation point of its capacity by the end of 1995, has the constraint that it is not feasible to expand its airside facilities including runways(while its landside facilities may be expanded. It was for this reason that the plan to build NSIA was conceived).

In case of the other airports, the runway capacities are generally sufficient, but the landside facilities are not. Some of the runways, however, are below par and, especially, airports being shared with the military have not enough capacities available for civilian use.

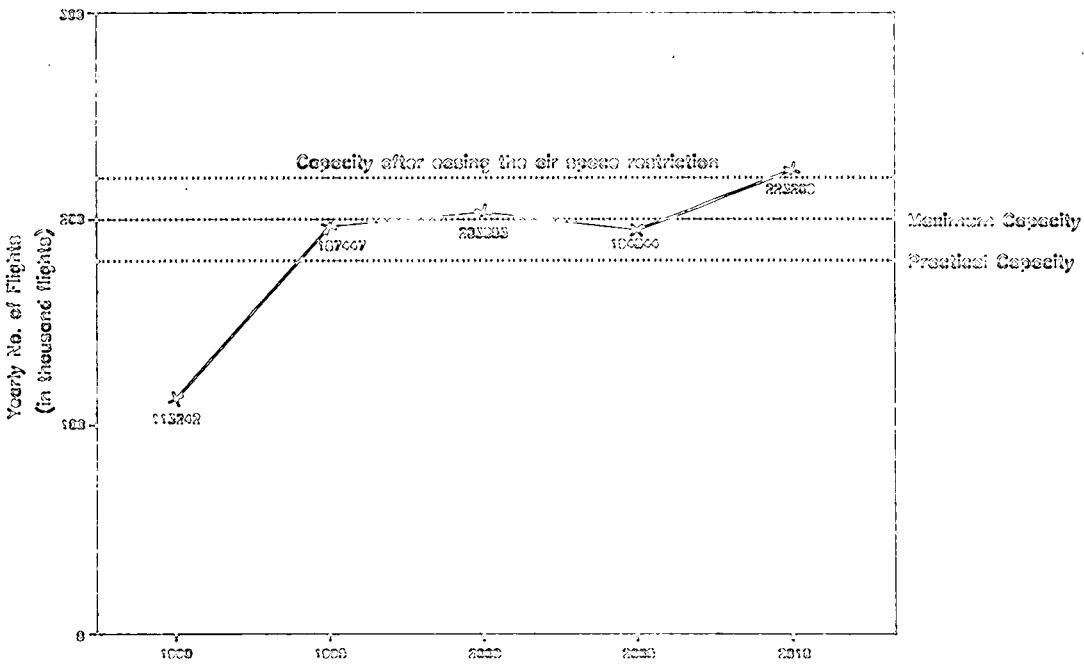


Figure 2. Kimpo Airport : Runway Capacity versus Aviation Demand

As for the structure of domestic lines, all the lines except Pusan-Kwangju line have their OD's at Kimpo and Cheju. Accordingly, the capacities of these two airports affect development of local airports. When seen from the runway capacity alone, Cheju Airport has some room left for facility expansion to meet the greater demand, but Kimpo Airport is expected to reach the saturation point by 1995.

The practical capacity of Kimpo airport (see Figure 2) is rated somewhere between 180,000 and 200,000 operations per year, and it may be increased to upwards of 200,000 operations if the present air space restriction is somewhat eased, but deterioration of the sevice level is inevitable beginning from the latter half of the 1990's.

4. Future direction of airport development

4.1 Development of Regional Base Airports

All the areas of Korea should be made accessible by road and rail, but to maximize the efficiency of the transportation system, air trasportation services should also be made available. In order to assign to airports scattered about in the country functions suited to their local characteristics in the national context, and to work out optimum development strategies, it can be useful to delineate airport zones.

As with the case of roads, it is also desirable to develop airports on the basis of an established hierarchy. In most cases, the hierarchy for airports comprises, according to the range of the region served, international airports, regional base airports, and regional airports. At present, Korea's airport zones are formed around the three nuclei of Kimpo, Kimhae, and Cheju and, in regions other than those served by these airports, the concept of regional base airoprt is yet to be formed.

When the topography, population distribution and physical development plans are considered, the Republic may be divided into 7 airport zones, each containing one regional base airport and one regional airport. The Government's airport development plans implemented to date, with the exception of Kyungbuk Province, have been based on studies done on the basis of the regions delineated as above. The Seoul Metropolitan area and Central Zone have already been finalized, and airports on Yongjong Island off the city of Inchon on the west coast and in Chongju are under construction as their regional bases, but the Pusan and Cheju zones have problems of relocating/newly constructing airports. The East Coast and Honam (Southwest) Zones are planning to develop new international airports.

It would be best to form a 5 international airport system by allocating an international airport in the Honam Zone (Southwestern Zone) in addition to 3 existing international airport zones, and to annex to the East Coast Zone and Kyungbuk Provincial Zone the function of an international airport, rather than developing a full scale international airport in these zones, since the international air travel demand in these zones would not be great.

In the case of the Central Zone, Chongju was originally selected as the site for New Seoul International Airport, but later the plan was changed and the site is now being developed as local airport. In light of the needs of the zone and the great development potential of the west coast, however, it can be an alternative to develop a base airport in Kunsan instead. It also might be an idea to make it a substitute airport for the Seoul Metropolitan area, or to relegate part of the function to meet the demand for international aviation of the Seoul Metropolitan area.

Intensity of the operation of international lines is bound to vary from base airport to base airport. The core international airport for now is definitely Kimpo, and

then, beginning from 2010, will be NSIA, and it would be desirable to set a difference in the scope of development between the group consisting of Kimhae, Cheju, and Kwangju Airports, and that consisting of Chongju(or Kunsan), Kangneung, and Taegu Airports, by orienting the former for short to medium distance international line services, and the latter for short distance and irregular international line services.

The future of the world aviation market will be characterized by intense struggle for survival in its general trend of global aviation liberalization touched off by the U.S.policy to ease restriction on aviation and Uruguay Round of talks and, eventually, there would emerge a limited number of mammoth airline companies through alliance and association. Accordingly, it is highly probable that airport networks will be formed in a hub and spoke pattern.

As is well known, NSIA on Yongjong Island is intended as a hub airport. Despite many difficulties involved, this must be realized, and the regional base airports should be linked to the long haul international lines operating out of the new airport.

At present, all regional base airports are linked, via domestic lines, to Seoul Metropolitan Airport (Kimpo) for long haul international lines. Development of Kunsan as the site for a regional base airport would consummate the nationwide airport linkage. Should Chongju be made the location of a regional base airport instead. however, it would be possible to visualize an organic link among NSIA on Yongjong Island, Kimpo and Chongju Airports, in the concept of the expanded Seoul Metropolitan airport system, with NSIA on Yongjong Island specializing in long haul international lines, Kimpo in medium to short distance international lines, and Chongju in short distance international lines plus part of handling of air cargoes, and this would not be unlike the intergrated operation of Narita Kansai, and Nagoya Airports which is being sought in Japan as a parallel to the NSIA scheme of Korea.

For domestic lines, on the other hand, regional base airports which are more than 150 to 200km apart one another should all be linked together. Its feasibility is as yet low for some sections for insufficient demand they have, but the condition would improve by 2000's to warrant its implementation.

4.2 Development of Regional Airports

The hierarchy of airports mentioned herein above includes regional airports as well as international airports and regional base airports. The regional airports, which handle only domestic line services, may be understood as interregional transportation facilities to supplement overland transportation services.

When seen in this light, the facilities of existing regional airports should be expanded to meet the demand, but new regional airports also should be built in areas with poor overland accessibility. With existing finalized plans to build new expressways and high speed rails taken into account, the Ulchin area in the southern part of Kangwon Province would be a typical one in need of a new regional airport, feasibility of whih is recognized by the Government authorities.

It is known that the authorities are also contemplating a new regional airport in North Cholla Province and , in this study, it is assumed that Kunsan be the location for the regional airport for the province.

The national needs for aviation could generally be met with a total of 17 airports. For congestion of the existing surface transportation facilities, however, there are quite a few other areas where a new airport also might be justified, i.e., medium or small urban centers and tourist resorts such as Taejon, Chonju, Taebaek, Chunchon, Inchon, Ichon, Wonju,

Chungju, and Sosan. For these areas, use of V/STOL aircraft may be considered which has relatively limited facility requirements. Development of airports of this category, however, should be weighed carefully, since its need would largely be dependent upon the progress of actual investments made in surface transportation facilities on one hand, and development of available V/STOL technology on the other.

4.3 Expansion of Airport Facilities

Many of the existing airports in Korea have physical constraints for expansion at their present locations. For this reason, the Government has undertaken feasibility studies of new airports for new locations such as Yongjong Island, Kimhae, Cheju, the east coast(the Kangneung area), and west coast(the Kwangju area). Of these, on Yongjong Island airport construction has already begun but, for the other locations, the plans are yet to be finalized for financing problems and, accordingly, they will be excluded from consideration in the present study.

Expansion of airport facilities should be sought to provide facilities matching the aviation demand both in quality and quantity. The Government plans to expand existing airports made so far, however, seem to be somewhat inadequate for the landside facilities. For the runway, a facility permitting little flexibility, a minimum length of 3,000m is required for international airports such as those in Kimpo, Kimhae, Cheju, and Kwangju. Hence, for Kwangju Airport, the runway, which is now 2,740m long, would have to be expanded to meet the requirement, should its proposed relocation is either delayed too long or cancelled.

The other regional base airports, namely Chongju (or Kunsan), Kangneung, and Taegu, have, or plan to have, a runway of acceptable specifications, and this is also true with regional airports, except for Sokcho and Mokpo airports, whose runways are only 1,500m or so long.

Logically, regional airports which are in use by smaller aircraft can have shorter runways, but in the case of Korea, regional airports will eventually require at least a runway of medium size because Korean airline companies are increasing the size, and simplifying the types, of their aircraft on hand.

The key to the problems with the Korean airports is to provide adequate capacity to the airport serving the Seoul Metropolitan area. The problems may be solved in the next century when the airport on Yongjong Island will be operational but, in the meantime, development of a 3 route aviation system should be seriously considered which could offer much flexibility for development of the regional airports in terms of their facilities and operation.

As is well known, the new airport on Yongjong Island was originally scheduled for completion in 1997, but the schedule was later postponed to 1999, with the date for its becoming operational set for 2000, thus affecting, in turn, the medium/short term plans of operation of kimpo Airport and the development of regional airports as well. To insure a minimum decency of operation of the Korean airport system, construction of the new airport should never be delayed any further.

Meanwhile, the total investment requirements for the other airports over the period of 1991 through 2000 are estimated at 684.2 billion Korean won, whcih is to be borne equally between the Central Government and the Korean Airport Construction Authority(KOACA). The recent Government's emphasis on infrastructure development and new tax measure for transportation have made the financing prospect somewhat brighter, but still, the possibility of delay in the investments in the regional airports annot be precluded since the financing burden for KOACA will be as heavy as 300 billion won each

for the new airport and regional airports during almost the same period of time. One alternative, therefore, may be to relieve KOACA of the financing burden for the latter by shifting it to the local governments concerned.

5. Outline of development plan for new Seoul international airport

In view of the rapidly inreasing aviation demand, Kimpo International Airport where the entire aviation demand of the Seoul Metropolitan area converges is expected to reach the saturation point of its capacity by the middle of the 1990's. It is not feasible, however, to expand its facilities to any sizable extent and, should construction of the new airport be developed, the inconvenience to the passengers using Kimpo Airport would become intolerable, and the international trade and other economic activities of Korea would be seriously affected to the detriment of the national development.

Thus, to keep the nation's competitive edge, to provide against the rapidly increasing aviation demand of the 2000's, and to successfully tide over the structural changes expected in the world aviation market, an airport must be developed that would meet the needs in the 21st Century, based on long and near term plans. This is how construction of New Seoul International Airport was sought which would have no noise problem and be operable around the clock.

The new airport development plan may be outlined as follows.

- Construction Schedule
  - Phase I : 1992 through 1999 (to make it operational by 2000)
  - Phase II and onward : to be implemented in stages by taking into account the aviation demand, available fund resources, etc.
- Facility Size

	Phase I	Ultimate Phase
Airport		
Site Area(in 10,000㎡)	1,097	4,744
Runway	1(3,750m×60m)	4(3,750-4,200m×60m)
Pax Terminal(in 10,000㎡)	29	87
Access		
Freeway	54.5km in 6-8 lanes	54.4km in 8 lanes
rail	Right-of-way Acquisition	Double-track 66km
Link Town(in 10,000㎡)	264	873

- Capacity
  - Phase I (annual) : 170,000flights, 27 million passengers, 1.7million tons of cargoes
  - Ultimate Phase(annual) : 530,000 flights, 100million passengers, 7million tons of cargoes

6. Conclusions

The international airports are not only lagging behind in their facilities, but have defects that can endanger operational safety. To form an integral national transportation system, the air transportation system should be streamlined along with the surface transportation system, and it is desirable that development of airports be sought with base airports and regional airports distinguished according to a hierarchy.

Regional base airports which will handle international line services should be equipped with facilities of international specifications, and regional airports would eventually require facilities of medium or

larger specifications in light of the problems Kimpo Airport has and the trend of the aviation market.

NSIA on Yongjong Island should be made a hub so that it can successfully tide over the structural changes expected in the world aviation market, and it is desirable to form the airport system for the Seoul Metropolitan area consisting either of NSIA and Kimpo Airport, or NSIA, Kimpo Airport and Chongju Airport, linked together, with functions assigned appropriately to them.

For proper function of an airport, development of access road and rail to it is also essential. For the vast investment needs for airport facilities and the facilities to support them, various measures should be worked out such as inducement of private capital and commercial loans which are often aired of late and transfer of the right to develop regional airports to the local governments. The nation's airport system could be brought to an advanced level if timely investments are made on a sustained basis.

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