Country	: People's Republic of China
Project	: Wuhan Tian He Airport Construction Project
Borrower	: The Ministry of Foreign Economic Relations and Trade, People's Republic of China (at present: The Ministry of Foreign Trade and Economic Corporation)
Executing Agency	: Civil Aviation Administration of China (CAAC)
Date of Loan Agreement	: March 1991
Loan Amount	: ¥6,279 million
Local Currency	: Yuan
Report Date	: June 1997 (Field Survey: October 1996)

General Outlook of Passenger Terminal Apron (From Control Tower)

[Terminology]

1. CAAC: Civil Aviation Administration of China

2. ICAO: International Civil Aviation Organization
   A specail UN agency dealing with aviation issues which was established on the basis of the International Civil Aviation Convention (the Chicago Convention)

3. Person-Kilometers
   Unit of volume for passenger services (product of number of passengers and the distance they travel).

4. Ton-Kilometers
   Unit of volume for cargo services
   (product of weight of cargo and the distance it is carried).

5. Passenger number
   The total of passengers departing from and arriving to an airport.

6. ILS: Instrument Landing System
   Devices which emit directional electromagnetic waves from the ground to enable aeroplanes to land on and take off from the runway precisely while flying by instrument guidance alone. Aircraft are equipped with instruments such as the localizer which recognizes lateral displacement in the aircraft's position, and the glide path which recognizes both lateral and vertical displacement in the aircraft's position.

5. Cat: Category
   These categories indicate the capabilities of the ILS system and under what degree of adverse weather conditions they are designed to enable the aircraft to land.
   Cat 1:Visibility 800m, cloud height of up to 200 feet.
   Cat 2:Visibility 400m, cloud height of up to 100 feet.

6. VOR: VHF Omnidirectional Radio Range
   This radio recognition system emits radio waves which indicate magnetic north and directional radio waves to inform the aircraft of its height and direction. (DVOR: Dual VOR)

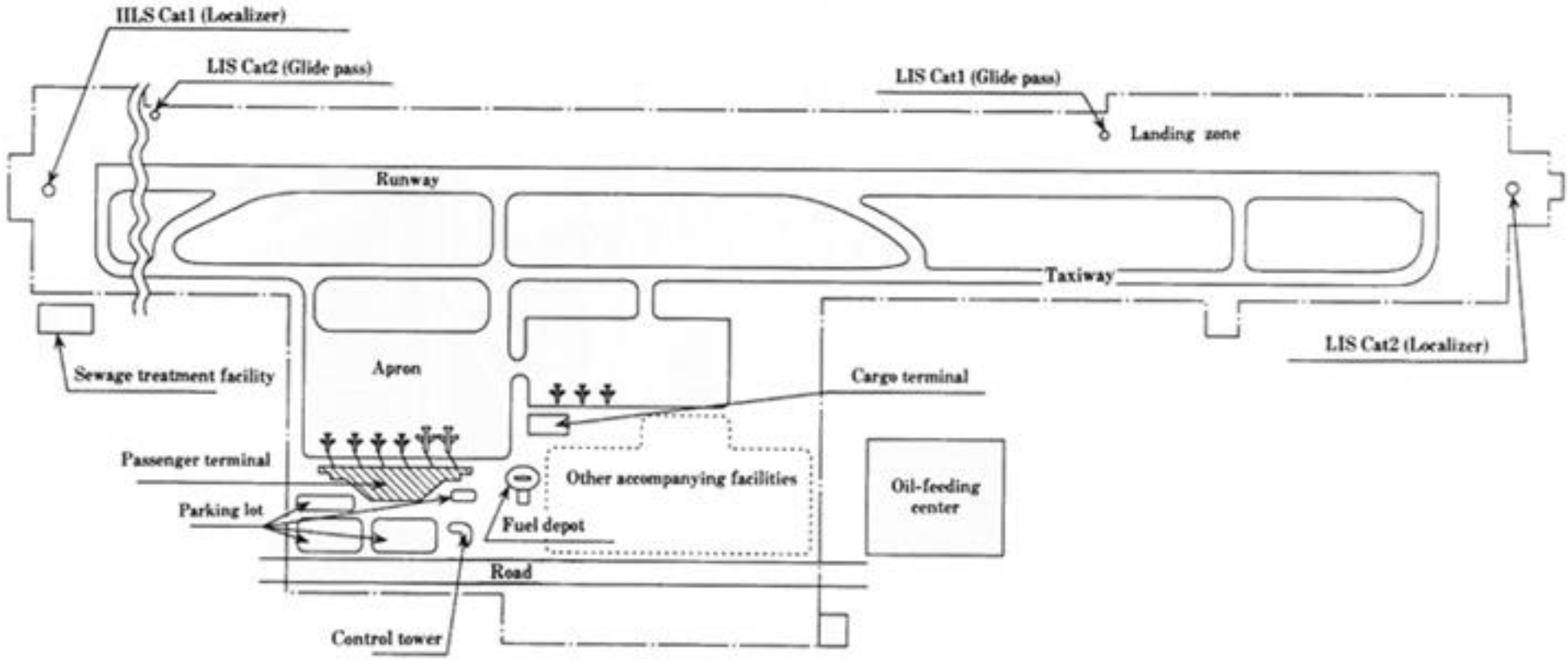
7. DME: Distance Measuring Equipment
   This devices makes use of the fact that the speed or radio waves is a constant to measure the distance to an aircraft.

8. NDB: Non Directional Radio Beacon
   This wireless device emits non-directional radio waves in all directions to assist in the navigation of the aircraft.

1. Project Summary and Comparison of Original Main Plans and Actual Results

1.1. Project Location

Rough Chart for Wuhan Tian He Airport



1.2. Project Summary

This project aims to keep pace with expanding demand for air transport in the city of Wuhan, Hubei province and to contribute to economic development in the region by constructing a new airport in the Tian He area approximately 40km Northwest of Wuhan. The new airport will have 3,000m of runways as well as takeoff and landing facilities, terminals and air safety facilities.

The finance provided by the OECF covers the entire value of foreign currency expenditure involved in this project.

1.3. Background

1.3.1. The Position of the Transport Sector in National Planning

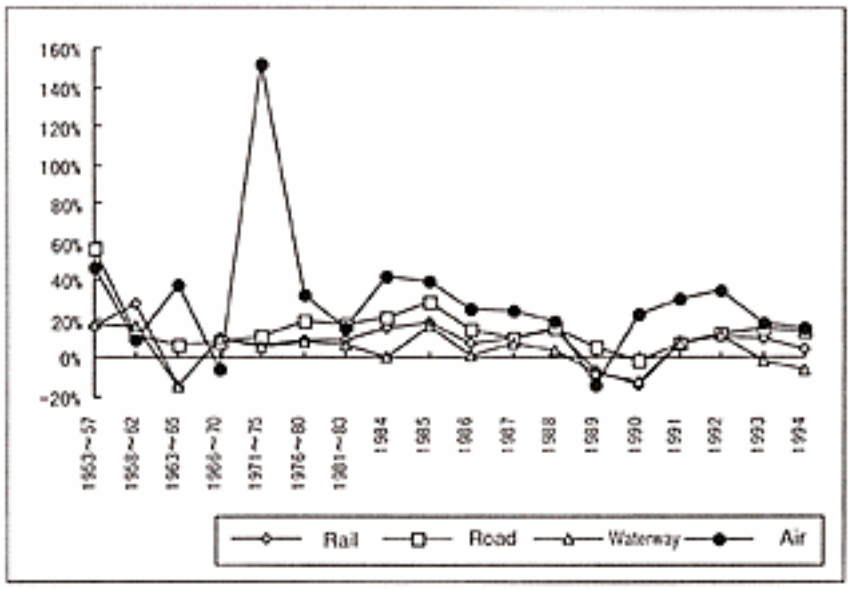
Between the late 1950s and the late 1970s economic management was founded on the doctrine of regional self-sufficiency which was led by People's Government Enterprises. Under this system the trans-regional transport infrastructure remained inadequate. However under the reform and liberalization policies which have been promoted since the 3rd Plenary Session of 11th Central Committee, Communist Party of China in 1978 have promoted economic interchange and stimulated international trade. This in turn has spurred a full-scale buildup of the national transport system.

The Sixth Five Year Plan which began in 1981 (1981～1985) made the improvement of the transport and shipping system, with emphasis on the shipping of energy resources, a pressing task. From then on the development of the transport sector was recognized as a task of paramount importance, ranking alongside the development of the energy sector (securing production of coal and oil). This was reflected in the national budget in which transport received approximately 14% of the total investment for construction. This emphasis on transport continued under successive five year plans (the seventh from 1986～1990 and the eighth from 1991～1995), with the aim of expanding and improving the transport system while securing a good balance between railway, road, waterways and air transport.

1.3.2. Summary of China's Air Transport Sector

The effective distribution of regionally imbalanced resources is a central and pressing task for China's transport sector and the bulk of investment is directed to the rail, harbor and waterways sectors which play the leading roles in this work. China does however have a vast land area and expanding population which means there is great latent demand for air travel, in which transportation of passengers is central. Although the absolute volume of the market is small, the air transport sector has shown outstanding growth rates in terms of person-kilometers and ton-kilometers since the inception of China's air transport operations in 1950 (See Figure 1 and Table 1).

To cope with the remarkable growth in the air transport sector the Seventh Five Year Plan strengthened the organization of the Civil Aviation Administration of China (CAAC, the agency with overall authority over civil aviation in China) and established a national air system as means of supporting regional aviation projects. Investment was directed to airport construction to cope with the expansion in international routes under liberalization policies and the concentration of domestic routes in the big cities. Investment emphasized the international airports (the big three being Beijing, Shanghai and Guangzhou), but the plan included new construction or improvement of a total of 40 airports includeing regional airports (in state capitals, prime economic areas and tourist regions).



Source:Chinese Statistiecal Yearbook

【Figure 1　Annual Average Rates of Increase in Ridership for Each Transport Sector】

【Table 1　Progress of Transport Volumes in Each Sector】

		FY52→FY90	FY75→FY90	FY85→FY90	
		Scale factor	Scale factor	Scale factor	Annual average growth rate
Passenger (Person-Kilometer)	Rail	13times	3times	1.1times	2%
	Road	114times	7times	1.5times	9%
	Waterway	7times	2times	0.9times	－1%
	Air	958times	15times	2.0times	16%
	Overall	23times	4times	1.3times	5%
Cargo (Ton-Kilometer)	Rail	18times	2times	1.3times	6%
	Road	240times	17times	1.8times	12%
	Waterway	79times	5times	1.5times	9%
	Pipeline	－	2times	1.0times	1%
	Air	410times	14times	2.0times	15%
	Overall	34times	4times	1.4times	7%

Source: Chinese Statistical Yearbook

1.3.3. The Position of Wuhan City

The municipality of Wuhan is located in Hubei province in the center of China. It comprises eight urban districts, two rural districts and four prefectures. It had an area of 8,126k㎡, (176k㎡ of urban districts), a population of 6.42 million (3.52 million in urban districts) when surveyed (in 1989). The city has flourished in the middle reaches of the Yangtze since ancient times and in 1949 the three historically famous cities, such as Wuchang, Hankou and Hanyang merged at the time of the formation of the new China to become one of China's five major cities (after Beijing, Shanghai, Guangzhou, Tientsin and Wuhan)

Economically, the Beijing-Guangzhou route which is the major North-South transport artery and the Yangtze which is a great East-West waterway cross here, making Wuhan an important crossroads. The area has abundant water resources and deposits of iron ore and coal. Many industries are thriving in this major center of heavy chemical industry. These factors make Wuhan one of the most significant inland cities. It also has considerable tourism potential and the importance of the tourist industry is growing as liberalization and reform policies move forward.

Within these liberalization and reform policies the economic strategy is focused on pushing the coastal zones forward, but in the Seventh Five Year Plan (1986～1990) the expansion of the area to the West and Center was adopted as a policy objective. The territory along the banks of the Yangtze is expected to serve as a beltway linking East and West and Wuhan is positioned as the key city in that development.

1.3.4. The Process Leading to the Construction of the New Airport

Wuhan has the Wuhan Nan Hu Airport which was established in 1954 as a civil airfield. When appraised by the OECF (1989) this airport was used by 465,000 passengers and 7,200 tons of freight per year. Its capacity was only 300,000 passengers per year so it was already operating beyond capacity.

Before the appraisal the growth in demand at the Wuhan Nan Hu Airport had been remarkable, rising by 340% in passenger volume (from 141,000 to 475,000) and by 260% in freight volume (from 3,100 tons to 8,700 tons) in the five yeas between 1982 and 1987. In 1989 demand dipped in the aftermath of the Tiananmen Incident, but in the medium and long term the growth trend has been uninterrupted. By 1995 demand had grown to 2.33 million passengers and 22,000 tons of freight while the figures for 2000 are expected to be 4.2 million people and 33,000 tons of freight.

To improve this situation an extension of the Wuhan Nan Hu Airport's 1,812m runway, the shortest runway among the country's top 15 passenger airports (see Table 2), has been studied. Such a runway would allow the takeoff and landing of large-scale passenger aircraft. However the Wuhan Nan Hu Airport is only 4km from the center of the city in a built-up area which makes expansion difficult. It has been decided that construction of a new airport is unavoidable if the growing demand is to be met.

By 1985 the Chinese Government had already chosen the Tian He area from a shortlist of five candidates as the site of the new airport and the construction plan was accepted. The decision was based on four main grounds:

① There were no apparent problems obstructing traffic to neighboring airports.

② The land is a broad expanse of flat agricultural land which allows land acquisition without pushing up the construction budget and the prospects for future expansion are good.

③ The climatic conditions and radar operation environment present no problems.

④ There are no problems affecting access from urban areas (high-grade roads approach).

【Table 2　Outline of Major Airports (1991)】

	Name of airport	No. of passenger (Thousand)	No. of bording and alighting(Thousand)	Length of runway(m)
1	Guangzhou	7,446	63	3,800
2	Beijing	6,310	60	3,200/3,800
3	Shanghai	4,939	44	3,200
4	Chengtu	1,670	18	2,800
5	Amoy	1,648	17	2,700
6	Kweilin	1,458	13	2,200
7	Xi'an	1,273	17	2,200
8	Hangzhou	1,044	13	3,200
9	Kunming	950	9	3,400
10	Hoihow	942	8	2,500
11	Foochow	892	10	2,200
12	Nanking	841	10	2,200
13	Shenyang	808	12	3,200
14	Wuhan(Nan Hu)	783	15	1,812
15	Shantou	759	5	2,500

Source: "Airport Review (CAAC)."

1.4. Comparison of Original Main Plan and Actual Results

1.4.1. Project Scope

Item	Plan	Actual result
1. Land acquisition etc	Inside airport (225ha), Outside airport (45ha)	272ha, 45ha
2. Takeoff and landing facilities		
Runway	3,000m×45m	3,400m×45m
Flightpath	176,000㎡	—
Apron	122,000㎡	Same as left
Landing zone	3,120m × 300m	3,520m×300m
3. Terminal facilities		
Passenger terminal	25,000㎡	28,400㎡
Special equipment for passenger terminal building	One set	Same as left
Cargo terminal	3,000㎡	Same as left
Road, parking lot	30,000㎡	Same as left
4. Air safety facilities		
(1) Radio facility	ILS, DVOR/DME, NDB	Same as left
(2) Air control facility	Control center building, interior equipment etc.	Same as left
(3) Communication facility	One set	Same as left
(4) Meteorological facility	Meteorological observatory, observing equipment etc.	Same as left
(5) Airport lighting facility	Approach lighting, Runway lighting etc.	Same as left
5. Varieties of utilities etc.	Electric power supply facility, fuel supply facility, airplane maintenance facility (hangar etc.), water and sewage facility (sewage treatment facility etc.), cooling and heating facility, city ticket selling center, access road, airport special vehicles	• Expansion of airport maintenance facility (9,300→13,800㎡) • No access roads
6. Other facilities	Fire-fighting garage, catering facility, garage, control building, staff lodging house, peripheral road, environmental preservation survey etc.	• Newly established customs facility

1.4.2 Implementation Schedule

	Plan		Actual result		Difference(months)	
	Start	Completion	Start	Completion	Completion date	Period
1. Land acquisition etc	1990/1	1991/2	1990/1	1992/12	22	22
2. Takeoff and landing facilities	1991/1	1992/3	1991/1	1994/5	26	26
3. Terminal facilities	1991/2	1992/12	1991/7	1994/9	21	16
4. Air safety facilities	1991/5	1992/11	1991/9	1994/5	18	14
5. Varieties of utilities etc	1991/2	1992/11	1991/5	1994/12	25	22
6. Other facilities	1991/4	1992/12	1991/5	1994/12	24	23
Total construction period (from start to completion)	1991/1	1992/12	1991/1	1994/12	24	24

1.4.3 Project Cost

	Plan		Actual result		Difference	
	Foreign currency (million yen)	Local currency (thousand yuan)	Foreign currency (million yen)	Local currency (thousand yuan)	Foreign currency (million yen)	Local currency (thousand yuan)
1. Land acquisition etc	0	33,690	0	111,945	0	78,255
2. Takeoff and landing facilities	543	37,970	543	183,920	0	145,950
3. Terminal facilities	826	13,700	1,432	61,302	606	47,602
4. Air safety facilities	1,607	5,480	840	75,958	－767	70,478
5. Varieties of utilities etc.	1,625	17,490	1,665	207,947	40	190,457
6. Other facilities	1,678	80,740	865	335,696	－813	254,956
(including consulting service)	18	0	18	0	0	0
Total	6,279	189,070	5,345	976,768	－934	787,698
Total of foreign and local currency(million yen)	12,782		23,083		10,301	

Note：Exchange rate When planned：1 yuan = 34.4 yen

Actual result：1 yuan = 18.16 yen (IFS annual average rate[1993～1995]

2. Analysis and Evaluation

2.1. Evaluation on Implementation

2.1.1. Project Scope

The following are main revisions to the plan.

①Extension of the runway ②Expansion of the floor area of the terminal facilities ③Cancellation of access road construction ④Improvement of all types of utilities.

The background to these changes and the reasons are as follows.

(1) Extension of the Runway

In the initial plan it was assumed that the runway would have to accommodate medium airliners such as Boeing 767s and A-300s which were becoming the workhorses on Chinese domestic routes at the time. Therefore the runway length was set at 3,000m. However, Wuhan Tian He Airport must also serve as an international substitute airport for unscheduled and additional flights on international lines and also for emergency landings (in cases of trouble such as adverse weather or low fuel). The length of runway was inadequate if the airport was to receive the Boeing 747 which is the standard aircraft on long-haul international routes. Therefore the decision was taken to lengthen the runway to 3,400m to accommodate the newest model of 747, the 747-400.

The details of the decision process leading to the runway extension are unclear, but it is likely that the wishes of the city of Wuhan for an upgrade to international airport status (boosted by a 1973 declaration by Zhou En-lai "The Need for Wuhan International Airport") played a part, as did the urging of South China Airlines (China's biggest air carrier) for an enhanced airport. The remarkable rise in China's demand for air travel and Wuhan's position as an air level hub make an undeniably strong argument for internationalization of the city's airport, to which the extension of the runway was an appropriate response.

(2) Expansion of the Floor Area of the Terminal Facilities

The expansion of the floor area of the terminal facilities (from the planned 25,000㎡ to 28,431㎡) is mainly intended to handle Boeing 747 landings. The expansion is reflected in changes in the original floor plan from the detailed design, but does not seem to pose any problems.

(3) Cancellation of Access Road Construction

In the initial plan access roads were to be constructed to flow into a trunk road leading to the terminal from the North which was under construction at the time of the study. It was decided to build another road first from the south of the terminal to give access from urbanizing areas (the

Hankou district). The budget for this route had already been determined as a future project. The access road from the south cut the direct distance from urban areas to the airport considerably, compared to the originally-planned northern trunk road. It was not included in the initial plan because of the increased paved distance and the need for a bridge to cross an intervening river (the Fu He) which would cost more than the northern route and take longer to construct.

Although the progress report on the construction of the southern access route confirmed that approximately 40% of the round was complete and work was about to start on the Fu He Bridge, it did not report further and thereafter the progress of the access route became unclear. In the end this construction was separated from the airport project and completed as an expressway (total length 17.8km×24m wide) as a BOT using private sector capital.

We have not been able to obtain information from the executing agency on the details or a summary of the BOT for the reason why the southern access route was made a separate project, but according to local newspapers and discussions with Japanese Banks in the region the total investment was some 450 million Yuan. Within this sum approximately 300 million Yuan was provided by the New World Group of Hong Kong and the remainder by the City of Wuhan. The amount borne by the City largely agrees with the amount confirmed by the progress report as the expenditure for the construction of the southern access road. It appears that as the capital shortfall problems of the project as a whole deepened the decision to separate the road project was taken as a means of reducing the total expenditure involved in the project and upgrading the road to an expressway to make the airport more conveniently accessible.

The introduction of investment from the New World Group of Hong Kang was originally considered as a means of relieving the project's capital shortfall, but the idea was dropped after the CAAC ruled that the introduction of private capital into an ODA project was improper. The idea then resurfaced in the form of making the access road construction a separate (expressway) project. This expressway project was made into a toll road as a way of securing profitability which, while it places a burden on the users, also allows faster transportation in greater volume so it can be regarded as positive contribution to the project.

(4) Improvement of All Types of Utilities

The above-mentioned enhancements to the project to make it an international airport have led to improvements in all airport facilities. The aircraft maintenance facilities (hangars, overhaul facilities etc.) were expanded from 9,300㎡ to 13,800㎡, new customs facilities were added (12,000㎡) and the number of special airport vehicles was increased from 53 to 141.

2.1.2 Implementation Schedule

Within the construction process the start of construction was largely on time with the exceptions of the communications and meteorological facilities. Completion on the other hand was overdue by two years overall. The main reasons were

①Ground improvement for the runway ②Extension of the runway ③Expansion of the terminal building ④A delay in agreement between the parties concerned over management of the airport after opening.

These reasons are considered in more detail below.

(1) Ground Improvement for the Runway

An unusual clay soil unsuitable for paving over was more widespread over the site than was believed at the time of the feasibility study, so the soil had to be replaced with other soil of better quality. The climate of Wuhan features heavy rains at the start of summer followed by humid weather at nearly 40℃ continuing from midsummer and these adverse conditions further delayed the soil replacement operation.

(2) Extension of the Runway

The decision to extend the runway was taken shortly before the runway was completed to the original length, so all the additional time required for the extension became a further delay.

(3) Expansion of the Terminal Building

The delay in completing the terminal facilities was due to design changes to adapt the terminal for handling Boeing 747s and was not a major problem.

(4) A Delay in Agreement Between the Parties Concerned Over Management of the Airport After Opening

A difference of opinion emerged between the City of Wuhan on one side and the CAAC on the other concerning the organization which was to manage the airport after it opened. The City of Wuhan wanted to establish a new public airport corporation under the umbrella of the Wuhan Tian He Airport Construction Supervision Department while the CAAC wanted to follow the precedent of the Nan Hu Airport and entrust management of the airport to the Hupei office of the CAAC. It took a long time to reach an accommodation in this dispute. Once the facilities were largely complete it took one year from the first test flights to completion (nationally collated) and a further four months from completion to opening. These delays were largely because of the result of this dispute.

2.1.3. Project Costs

The procurements for foreign currency portion were mainly made by Western and Chinese businesses, so the rise of the Yen (1992: 1 Yuan=¥23, $1=¥127. 1994: 1 Yuan=¥12, $1=¥102) yielded a cost under-run of approximately ¥900 million (from ¥6.28 billion to ¥5.35 billion). This under-run broke down into a cost rise of ¥650 million due to enhanced equipment within the terminal and larger unmbers of specilal airport vehicles and a cost fall of approximately ¥1.58 billion due to the reduced cost of procuring aircraft safety equipment and other maintenance management equipment. This reduction was mainly a benefit of the stronger Yen.

Within the local currency expenditure there was an enormous fivefold cost over-run from 190 million Yuan under the initial plan to 980 million Yuan. The main factors behind this over-run were the expansion of construction, the increasing number of items procured and the rise in their prices. The extra 790 million Yuan breaks down as follows.

①Increased cost of land acquisition (by 80 million Yuan). ②Ground improvement for the runway, and its extension (150 million Yuan). ③The increased scale of the passenger terminal and other changes in the scope of the project in terms of area and the range of other facilities (560 million Yuan). (The deficit of the project was financed from Wuhan City 〔350 million Yuan〕, CAAC〔130 million Yuan〕, others〔310 million Yuan〕).

Firstly ①the increase in the cost of acquiring land was due to the greater size of the plot (225ha up to 272ha), which caused the greater number of displaced people, the increased number of houses constructed to house these people in their relocation area, and the increased unit costs of land acquisition and relocation.

②The costs for ground improvement and extension for the runway over-ran because a large volume of high-quality soil fill was required to cover unsuitable clay soil (to a maximum thickness of 2 m). The extension increased the size of the task and the quantity of concrete etc. required.

③Construction costs were also increased by expanded size and scope of operations of the terminal which required more area for the passenger terminal and the aircraft maintenance facilities and the addition of new customs facilities.

Furthermore 1993, the year of greatest expenditure, saw a dramatic increase of 33.7% in the price of capital goods which was passed on to a large expansion of the overall local currency expenditure.

It is certainly possible that the original estimate for the local currency cost of the project was understated in order to gain state approval for the project. The reasons are ① the project was under severe budgetary constraints because it was intended to use the remainder of the third round of ODA loans to China and ② a stringent investment limitation policy had been in force for the two years before the start of construction. For these reasons, concerning those aspects of the main airport

facilities which were studied in depth on the feasibility study conducted by JICA, the specifications were reduced in the initial plan at the time of the appraisal. These specification cuts centered on the terminal facilities. This process reduced the estimate for local currency expenditure from 350 million Yuan at the feasibility study stage to 190 million Yuan.

【Table 3　Movements in Inflation Rates for Prices of Capital and Consumer Products in China】

	1989	1990	1991	1992	1993	1994
Capital products	18.9%	4.4%	8.0%	9.3%	33.7%	16.7%
Metallurgical industry (steels etc.)	21.0%	10.3%	14.2%	14.2%	57.7%	6.8%
Construction materials (cement etc.)	23.6%	-0.4%	6.1%	11.1%	42.8%	7.6%
Inflation rates in consumer goods	18.3%	3.1%	3.5%	6.3%	14.6%	24.2%

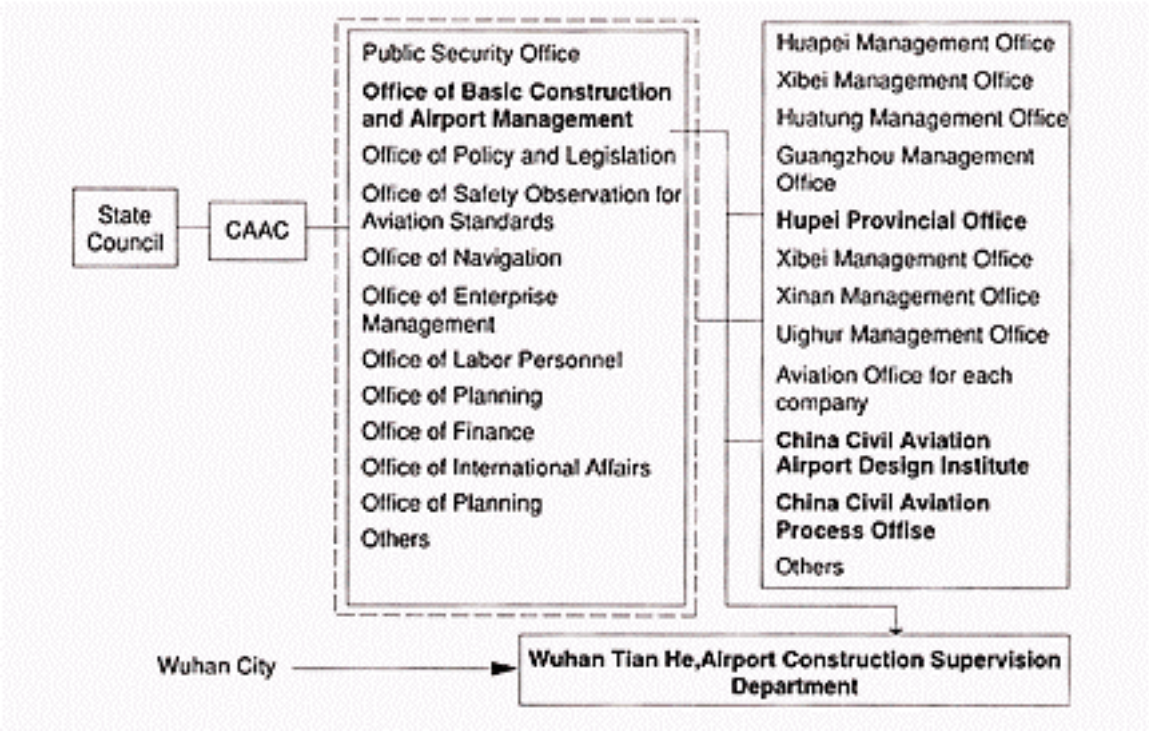
Source: "Chinese Statistical Yearbook.", IFS

2.1.4. Implementation Scheme

The executing agency for this project is the Civil Aviation Administration of China (CAAC). The CAAC was established in November 1949 and has been running civil air transport services since 1950. Regional management offices were established in an expansion and reorganization in 1962, running civil aviation offices and airports in each province, autonomous area and city. In 1980 it was brought under the direct jurisdiction of the State Department, strengthening its management structures. In 1984 the airline company was hived off and established as an independent entity based on the regional management offices while the CAAC itself retained only the administrative functions.

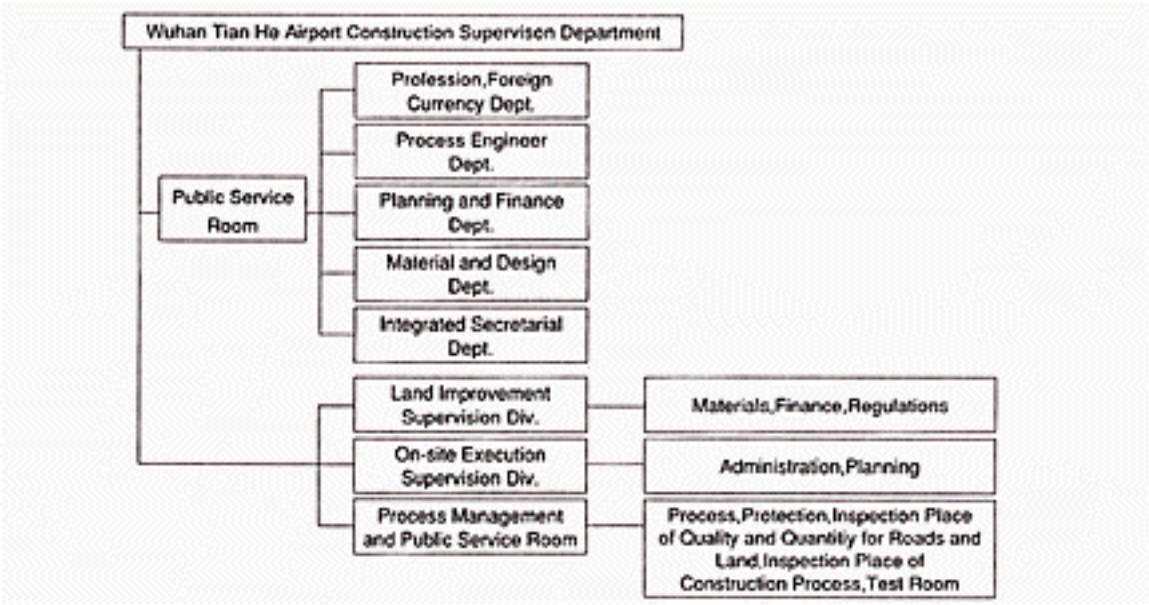
In the implementation of this project the CAAC used its consulting subsidiary organization, the China Civil Aviation Construction Consulting Company, to conduct the initial feasibility study, including site selection. This initial study was completed in May 1988 and was filled out by JICA to become the final feasibility study in March 1990. The detailed design was also drawn up by a subsidiary organization of the CAAC, the China Civil Aviation Airport Design Institute, which handles the design work for construction of airports. The construction and supervision of the project was directly managed by the Wuhan Tian He Airport Construction Supervision Department which was formed by a consortium of related agencies formed expressly for the purpose (see Figure 2).

The organization of the Wuhan Tian He Airport Construction Supervision Department is as shown in Figure 3. It mainly comprises experts seconded from the CAAC head office (the Office of Basic Construction and Airport Management) and the China Civil Aviation Airport Design Institute, as well as staff from the CAAC Hupei Provincial Office and the City of Wuhan. The city played a major role in the financial and personnel aspects of the project, having provided a majority of the staff and borne around half of the burden (445 million Yuan) of the cost over-run in local currency expenditure.



Source: CAAC, China Transport Economic Survey (1986), China Country Sector Survey Report (1985)

【Figure 2　Organization Chart of CAAC (at the time of appraisal)】



Source: Materials from Wuhan Tian He Airport Construction Supervision Department

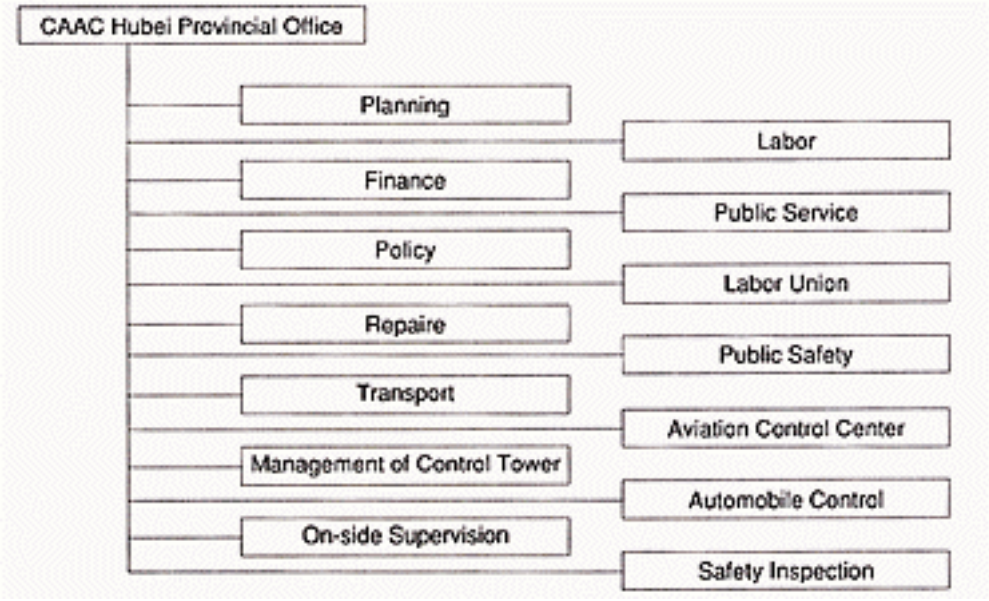
【Figure 3　Organization Chart of Wuhan Tian He Airport Construction Supervision Department】

2.2 Evaluation on Operation

2.2.1. Operations and Maintenance Scheme

The CAAC Hubei Provincial Office (see Figure 4) carried on the Nan Hu Airport to take on the operation and maintenance management of the Wuhan Tian He Airport. The airport's operation and maintenance management is expected to be conducted according to the provisions of the "Fundamental Technical Requirements"[1] which are standard nationwide regulations for the operation and maintenance management.

The Repair division is responsible for the maintenance and repair of the facilities, inspecting and servicing the facilities according to the above-mentioned "Fundamental Technical Requirements". In particular, daily inspection tours of the navigation and landing lights and control equipment are compulsory and other inspections must be conducted at weekly, monthly and annual intervals with records of all results preserved.



Source: Materials from Wuhan Tian He Airport Construction Supervision Department

【Figure 4　Organization Chart of the CAAC Hubei Provincial Office】

[1] These requirements were issued in 1991 to guarantee safety of takeoff and landing for civil aircraft in China. The requirements are divided into three groups: ①Runway and flightpath regulations, ②Airspace over airports, ③ Navigation and landing lights.

2.2.2. Operations and Maintenance

Although the construction of the project was completed in December 1994, the organizational wrangling between the City of Wuhan and the CAAC and the delay in shifting operations from the Nan Hu Airport set the opening of the airport back to April 1995. Since then there have been no major problems in the running of the airport and such minor difficulties as have arisen have been dealt with internally. The currect state of the main facilities is as described below.

After the opening of Wuhan Tian He Airport, the old Nan Hu Airport was originally intended to remain in use at first as an airfield for light aircraft only, but it is now disused.

(1) Runway

The usage of the runway in 1995 stood at approximately 22,000 takeoffs and landings (ranking eleventh in the country), far exceeding the 12,000 (ranked twentieth) recorded by the old Nan Hu Airport in 1993. The additional 400m of runway is used occasionally for Boeing 747 landings because this is an international substitute airport, but the actual rate of usage is low and will remain so until the airport becomes fully international.

The runway surface is being maintained in a good condition as might be expected because it has only been in use for a few years and efforts are made to discover any defective areas through a daily visual inspection.

(2) Passenger Terminal

In 1995 two million passengers passed throught the terminal, which is keeping pace with the increasing demand. The plan is to handle 4.2 million passengers by the year 2000 so there should be enough spare capacity in the facilities (lobbies, counters, baggage inspection equipment, baggage handling equipment etc.) but in fact some areas (check-in lobbies on domestic routes etc.) do become congested at peak times. For the time being it should be possible to deal with this congestion through improved operating procedures by the airlines. However according to South China Airlines, China's largest airlines and the airport's major user, Wuhan Airline Company (a non-CAAC affiliated airline) is currently using Wuhan Wangjiadun Airport (a joint civil/military airport), but plans to shift its flights to the new airport. Therefore South China Airlines is calling for early expansion of the airport.

The international facilities of the airport are now used only for one regional return flight to Hong Kong and for emergency and unscheduled international flights. Approximately half of the facilities are completely unused and the usage rate overall is extremely low. However the scale of these facilities is the bare minimun for international services. They are likely to become rather cramped

once regular flights begin on international routes.

(3) Boarding Bridges

Of the six boarding bridges, which are among the major facilities of the passenger terminal, the three for use with Boeing 737s were only used for half a year after the airport opened because of concern that they could be damaged when coupling with the aircraft entrance door (due to the padded parts on the bridge tip catching on pitot tubes etc.). Now buses are used as a substitute and the airport management are trying to resolve the problem by cuting away some of the pad material, but the bridges were obtained from a first-class manufacturer. It is unlikely that the problem is one of bridge design. The probable cause is a lack of on-the-job training in the use of these bridges.

2.2.3. Usage of the Airport

The records for usage of the airport since it opened are as shown in Table 4. In 1995 the number of passengers was 1.94 million while in 1996 the number was 2.31 million. These figures are roughly one year behind the predicted volumes which put the number for 1995 at 2.33 million. The freight handling volume in 1995 was 25,000 tons, rising to 34,000 tons in 1996, exceeding the 22,000 tons predicted at the time of the appraisal. Both the passenger and freight volumes transported seems to be developing steadily (see Table 4 and 5).

【Table 4　Usage of major airports】

Nan Hu Airport←→Tian He Airport

		1990	1991	1992	1993	1994	1995	1996
No.of passengers								
China as a whole	Thouasand	30,425	39,848	53,385	65,380	78,585	99,979	
Growth over previous year			31%	34%	22%	20%	27%	
Wuhan・Tian He (Nan Hu)	Thouasand	563	783	1,033	1,089	1,415	1,939	2,313
Growth over previous year			39%	32%	5%	30%	37%	19%
Beijing・capital	Thouasand	4,821	6,310	8,700	10,289	11,641	15,045	
Growth over previous year			31%	38%	18%	13%	29%	
Shanghai	Thouasand	3,984	4,939	6,152	7,595	8,718	11,076	
Growth over previous year			24%	25%	23%	15%	27%	
Guangzhou	Thouasand	6,045	7,446	9,015	9,269	10,702	12,575	
Growth over previous year			23%	21%	3%	15%	18%	
Volume of freight								
China as a whole	Thouasand	658	787	998	1,229	1,450	1,966	
Growth over previous year	ton		20%	27%	23%	18%	36%	
Wuhan・Tian He (Nan Hu)	Thouasand	8	10	14	15	19	25	34
Growth over previous year	ton		22%	38%	7%	26%	36%	37%
Beijing・capital	Thouasand	142	152	187	225	242	371	
Growth over previous year	ton		7%	23%	20%	8%	53%	
Shanghai	Thouasand	127	156	187	236	270	366	
Growth over previous year	ton		23%	20%	26%	15%	36%	
Guangzhou	Thouasand	125	151	171	188	234	279	
Growth over previous year	ton		21%	13%	10%	24%	19%	

Souce: "Airport Review 1996 (CAAC)"

【Table 5　Usage of major routes】

Section		No.of passengers (Thousand)				Volume of freight (Ton)			
		1992	1993	1994	1995	1992	1993	1994	1995
Wuhan	Beijing	122	136	247	350	1,368	1,630	2,298	2,726
Wuhan	Guangzhou	312	299	387	492	5,315	4,925	5,988	8,402
Wuhan	Shanghai	138	182	267	355	1,837	2,564	3,720	5,294
Wuhan	Shenzhen		76	145	234		1,142	2,298	3,193
Wuhan	Amoy			82	121			1,197	2,341
Beijing	Shanghai	850	1,031	727	1,706	20,976	23,205	11,159	60,128
Beijing	Guangzhou	867	993	1,003	1,265	17,440	21,131	27,462	44,113
Shanghai	Guangzhou	916	888	864	991	24,144	25,605	29,148	38,164

Source: "Airport Review 1996 (CAAC)"

2.3.4. Relocation of Residents and Environmental Considerations

The Tian He area of Wuhan where this project was constructed is a large expanse of flat agricultural land on the outskirts of the city, approximately 40km from the center. Most of the residents of the area were farmers. Around 800 households (approximately 3,500 people) from the

project construction site and its surroundings were awarded compensation for the acquisition of the project site and around 900 new houses were provided. The relocation process greatly improved the living conditions of those who were relocated and their reaction to the relocation was favorable, so the process was conducted smoothly.

The relocation of these residents means that the area subject to noise problems is uninhabited and a waste water treatment facility could be constructed which prevents water pollution problems due to water drained from the terminal building and other facilities on the site. Since the airport opened, the environmental protection offices of the city and prefecture have begun periodic monitoring of noise and water pollution (although noise monitoring is not currently conducted because there is practically nobody living near the airport).

This project was the first ODA loan project for airport contruction in China. The creation of a land usage plan considering the impact on the local environment after the completion of the airport was added to the scope of the project. This plan was drawn up by a Japanese consultant, which included predicted noise levels in its investigation report and drew up development plans for each area around the airport with reference to the expected noise level there. Specifically, areas along the axis of the runway where noise levels will be very high could be used for parks, while other areas with less noise impact could be used for convention centers and other such facilities. This plan has a long term vision for the area, based on the assumptions that the airport becomes inernational hub airport.

2.3.5. The Financial Management and Financial Condition of the Executing Agency[2]

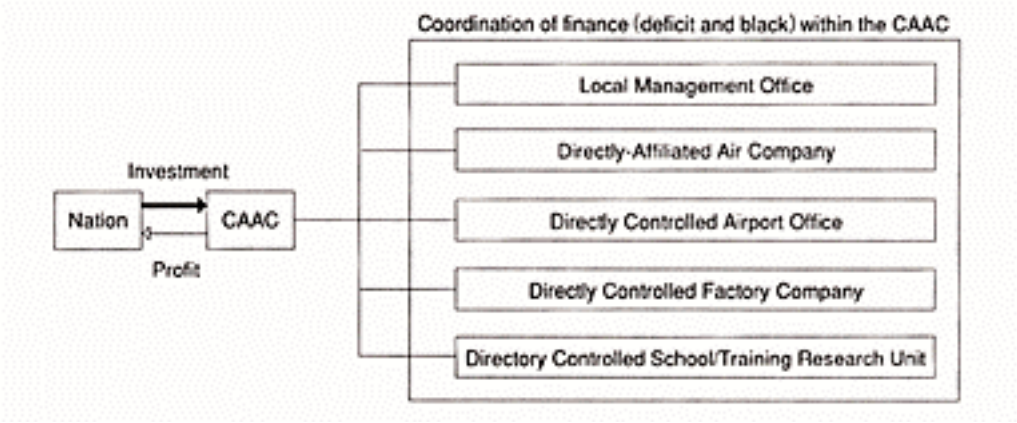
The flow of financial management within the CAAC is as shown in Figure 5. The CAAC is responsible for distributing investment funding and collecting operating profits. Its subsidiary organizations such as the regional management offices and the directly-affiliated air companies all have some degree of independence and they have largely adopted their own profit systems. The financial accounts published by the CAAC include this group of enterprises and their financial conditions were analyzed from these accounts

As far as can be seen from balance sheets for two years and accounts of income and expenditure for 1990～1995 the CAAC is expanding its operations rapidly while increasing its profits and building a sound asset base, although its liabilities are increasing due to procurement of the funds for expansion. At present the CAAC is in an initial investment phase in which the construction and expansion of major airports and expansion of its stocks of aircraft require enormous sums. Considering the size of

[2] The documents available were limited and the analysis was based on the balance sheets for two years before the airport opened (FY 1993 and FY 1994) and accounts of income and expenditure for six years from FY 1990 to FY 1995 (from 1992 onward accounts only covered information on income).

China's latest demand the balance sheet can be expected to keep on expanding.

Procurement of funds by share issues by CAAC-subsidiary companies includes the flotation of South China Airlines on the New York Stock Exchange which is now (FY 1996) under preparation (i.e. in discussions with the CAAC's director of planning supervision). Advertisements soliciting private sector investment in airports often appear in the newspapers and elsewhere. The kind of swift response needed to keep pace with the rapid growth of demand which can be expected in future will also be required in other fields of economic activity. Securing the necessary funds by whatever means is one of the CAAC's prime tasks.



Source: Ministry of Transport "Cooperation Survey for Safety Program of Air Transport (China)"

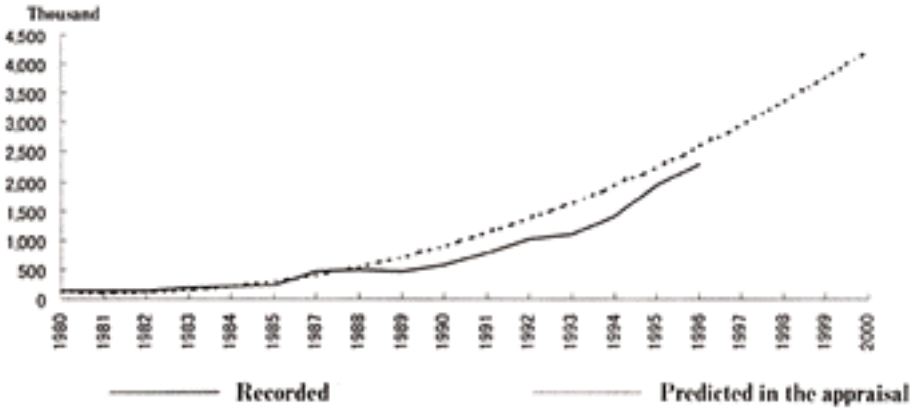
【Figure 5　The Flow of Financial Management within the CAAC】

2.3. Effects of the Project

2.3.1. Keeping Up with Increasing Demand for Air Transport

Demand for air transport in Wuhan is still growing steadily and the target of 2.33 million passengers in 1995 was largely attained, although one year late, with the 2.31 million passengers recorded in 1996. The movements in recorded demand for air transport can be seen below in Figure 6, which shows that actual demand was straying from the initial prediction until 1994. The main reason for this diversion was the continuing use of the Nan Hu Airport during the two years of delay in opening. The old airport reached its upper limit of passenger handing and passenger numbers could rise no further. Since 1995 and the opening of the Tian He Airport the trend has shifted dramatically to the rise.

【Figure 6　Comparison of Predicted and Actual Passenger Demand
at Wuhan's Airports (Nan Hu and Tian He)】



Source: Feasibility Study by JICA,

Demand for air transport in China as a whole in 1995 was 100 million passengers with a total transport volume of 68.1 billion person-kilometers. Comparing this with China's other domestic transport sectors air transport is the one with the highest rate of growth (see Table 6). Even compared with other countries passenger transport volume is on a par with developed coutries and ahead of France (see Table 7).

Wuhan is situated in the center of mainland China (if the autonomous regions are excluded), being around 1,200km from most of the major metropolitan areas (a flight time of 1.5～2 hours). This situation gives Wuhan the potential to become an air transport hub equal to Beijing, Guangzhou and Shanghai and it can be expected to play a major role in handing the booming demand for air transport throughout China. Furthermore, South China Airlines sees Wuhan as its second-ranked hub after Guangzhou, so the city's links with neighboring regions by small and medium flights will continue to strengthen. In the future when the airport becomes fully international its rise to hub airport status will be promoted, further increasing its importance.

【Table 6　Development Situation of Transport Volume by Sector】

		FY85→FY90		FY90→FY95	
		Scale factor	Annual average growth rate	Scale factor	Annual average growth rate
Passenger (Person-Kilometer)	Rail	1.1 times	2%	1.4 times	7%
	Road	1.5 times	9%	1.8 times	15%
	Waterway	0.9 times	-1%	1.0 times	0%
	Air	2.0 times	16%	3.0 times	28%
	Overall	1.3 times	5%	1.6 times	12%
Cargo (Ton-Kilometer)	Rail	1.3 times	6%	1.2 times	5%
	Road	1.8 times	12%	1.4 times	9%
	Waterway	1.5 times	9%	1.5 times	12%
	Pipeline	1.0 times	1%	0.9 times	-1%
	Air	2.0 times	15%	2.7 times	25%
	Overall	1.4 times	7%	1.4 times	8%

Source: Chinese Statistical Yearbook

【Table 7　Changes of Air Transport Volume by Country】

a. Total transport volume　(100million ton/kilometer)

	1960	1970	1975	1980	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
China	0.4	0.5	1.7	4	13	15	20	23	21	25	32	43	51	58	71
U.S.A.	71	267	323	458	594	657	733	776	805	842	822	880	898	967	1,004
U.K.	7	23	37	68	84	88	102	112	118	136	134	154	174	196	217
Japan	1	16	34	63	84	92	107	121	134	136	134	145	147	162	180
France	6	17	32	51	65	67	74	80	85	89	82	89	96	113	115
World over			839	1,293	1,666	1,780	1,966	2,112	2,235	2,359	2,269	2,440	2,512	2,715	2,923

Note: Hong Kong is included in China.

b. Passenger transport volume　(100million ton/kilometer)

	1960	1970	1975	1980	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
China	2	2	15	40	117	146	189	216	187	230	301	406	478	552	681
U.S.A.	625	2,131	2,620	3,930	5,279	5,800	6,470	6,743	6,948	7,314	7,183	7,651	7,759	8,200	8,492
U.K.	73	192	302	570	632	643	767	840	884	1,018	997	1,138	1,262	1,378	1,518
Japan	11	143	301	520	647	651	742	849	928	996	982	1,077	1,108	1,180	1,311
France	52	137	233	339	395	394	444	476	513	522	477	543	601	675	680
World over			6,912	10,714	13,601	14,427	15,914	16,955	17,784	18,941	18,261	19,526	19,708	20,861	22,301

Note: Hong Kong is included in China.
Source: Airport Review

2.3.2. Contribution to Economic Development

Wuhan was internationally opened in 1990 and was designated as an internally open city in 1992. These moves increased the inflow of development finance. This project which began construction in 1991 was one of the first signs of this trend, together with a project for the improvement of water

purification facilities (with loans from Canada and Australia), a telephone infrastructure project (with a loan from Germany) and the Second Yangtze Bridge project (with an ODA loan) which all happened at around the same time. In addition to being a transport center Wuhan has already developed other industries including steelmaking by the Wuhan Steel Company (one of China's major steel manufacturers), a textile industry based on the raw cotton which is one of Hupei's major products, and a bottled water industry using the city's abundant water resources. The improvement of infrastructure for these industries has made Wuhan an even more attractive target for investment.

This infranstructure buildup acts as pump-primer, drawing leading foreign companies from around the world such as Citroen (France), Coca Cola, Pepsi Cola and Budweiser (United States) to set up joint ventures etc. in Wuhan. Foreign investment and business expansion in Wuhan is gathering momentum and will countinue to do so in the future. By 1995 the total numbers of foreign firms who has set up in Wuhan in some form amount to approximately one thousand, and become around three thousand including those who are scheduled to do so. The characteristic of these foreign investments in Wuhan is that they are not the kind of obviously export-oriented companies seen in the coastal regions, but rather they are aiming at China's domestic demand. They can be expected to achieve stable development with little influence from the vagaries of international market conditions and exchange rate fluctuations.

This project has provided Wuhan with necessary infrastructure for industrial development and made the city more attractive to foreign investment. In doing so it has made a great contribution to promoting Wuhan's industrial development. Moreover, adding an air transport hub to Wuhan's already-important position within the river and rail networks will enable it to stimulate economic development along the Yangtze and in nearby regions, thus promoting China's inland economic development and progress for the country as a whole.

2.3.3. Other Effects

Other benefits yielded by this project include increased convenience and efficiency as well as improved safety for the airport's users.

(1) Improved Safety

This project has a long runway and a surrounding environment free of obstructions which enhances the safety of those on the planes and those living nearby on the ground by increasing the stability of the pilot's actions during takeoff and landing. At the Nan Hu Airport which had a short runway there was a high risk of slipping in rain and there had been cases of landing aircraft overshooting the runway. The way the town crowds up to the boundaries of the airport means that the damage could be enormous in the event of an accident. This project has solved such problems.

(2) Improved Convenience and Efficiency

When the Nan Hu Airport was in use the limitations of runway length made the Boeing 737 (capacity around 130 passengers) the largest aircraft which could land there. On routes with high demand such as those to Beijing, Guangzhou and Shanghai all flights were unavoidably fully booked at all times. However now the Tian He Airport is available with a runway of adequate length the Boeing 737 remains the workhorse, but Boeing 757 (capacity around 180 passengers) flights were added, increasing the passenger capacity and making it easier to get a seat. As the runway can accommodate aircraft as large as the Boeing 747 (having the biggest capacity), in the future it will be possible to accommodate whatever types of aircraft might appear. The capacity to accept flights and convey passengers on whatever aircraft are needed to meet demand will greatly increase efficiency.

The expanded area of the terminal, the increased numbers of chesk-in counters, the introduction of a baggage handling system, the upgrading of the access road to an expressway (outside the scope of this project) and other enhancements have all helped to reduce waiting times and speed processes for the convenience of the user.

2.3.4. Economic Analysis

Economic analysis of this project was based on an assumed project cycle of twenty years and at the time of the appraisal FIRR of 12.3% and EIRR of 16.6% were assumed. When these calculations were reviewed in the light of actual records as part of this evaluation the FIRR was down to 1.0% and the EIRR was down to 10.7%. (In this calculation the executing agency did not provide sufficient financial information. For the calculations of maintenance management expenses and airport project profitability, the PCR values provided were used unchanged.)

The reason for the slump in FIRR was mainly that the costs of the project had increased by a broad margin. However in the calculation of EIRR the fact that the per-capita hour-value of a Chinese person's time has increased threefold increased the benefit, so the EIRR did not fall far below the expected value despite the impact of the project's cost over-run.

Departure Lobby for Local Lines

Baggage Inspection Equipment for International Lines