4 IDENTIFICATION OF PROBLEMS AND ISSUES

4.1 Assessment of Existing Facilities and Systems

As many airports in Vietnam were constructed more than 20 to 30 years ago, facilities in the airports have deteriorated and become outdated. Airside pavement, runway, passenger terminal buildings, cargo-handling facilities are now facing a capacity problem. Airport facilities can be categorized into airside facilities, landside facilities and air navigation facilities. Airside facilities mainly provide the capacity for aircraft and its safety operation while landside facilities provide the service for passengers and cargo.

1) Airside Facilities

(1) Runway: Current air traffic volume in most of the airports in Vietnam is not very high. The busiest airport in Vietnam is Tan Son Nhat International Airport. According to the SAA, aircraft movements in this airport are approximately 85 to 100 takeoffs and landings per day including both domestic and international flights.[1] Aircraft movements in other airports are much less than this figure.

A single runway system is sufficient for this level of traffic volume.[2] There is no capacity constraint in the number of runways and runway systems in Vietnam now. However, besides capacity increase, an additional runway is useful to avoid total airport closure in case of accident, runway repair, etc. in important airports such as the three international airports. There are two runways at Danang Airport and Tan Son Nhat Airport. From this viewpoint, an additional runway may be useful at Noi Bai International Airport.

Runway length is another factor that affects the capacity of an airport. Insufficient length of runway limits aircraft operations. Runway length is calculated based on the aircraft type, flight distance, airport elevation, and airport temperature. If runway length is not enough for a particular aircraft, weight restriction is applied on the aircraft, or airlines must use smaller aircraft. According to CAAV, weight restriction caused by insufficient runway length is applied in the following airports:

- Noi Bai International Airport
- Danang International Airport
- Tan Son Nhat International Airport
- Cat Bi Airport (Haiphong)

[1] As of April 1999
[2] "The annual capacity of a single runway airport configuration could exceed 195,000 (annual) operations with suitable taxiway, apron and air traffic control facilities." ICAO Airport Planning Manual Part1 Master Planning 6.3.3.

The runway length in the three international airports is sufficient for domestic operations. Weight restriction is needed in international long haul routes, such as to Paris, Dubai and Moscow.

Another factor that limits the aircraft takeoff weight in Vietnam is the obstacles in the approach and takeoff surface. According to the CAAV, there are obstacles in the approach and takeoff surface in the airports of Dienbien and Phu Quoc. A detailed obstruction survey and other necessary measures should be implemented to secure operational safety in these two airports.

ICAO recommends dimensions of runway and runway strip for operational safety. The runway width is less than the ICAO recommendations at the following airports:

- Dien Bien Airport
- Vinh Airport
- Phu Bai Airport
- Pleiku Airport
- Buon Ma Thuot Airport
- Lienkhuong Airport

(2) Taxiway: Because current traffic volume is low, taxiway systems in Vietnam are not facing a capacity problem now. Dimensions of taxiways meet ICAO recommendations.

A review of taxiway utilization plan is required. Most of the airports were constructed by the military so that there are many taxiways compared to civil aviation airports. Parallel taxiways may not be necessary in most of the airports with current low traffic volume. Pavement rehabilitation should be concentrated on the necessary pavement area to utilize the limited budget.

(3) Apron: There is no capacity constraint in the apron in most airports under current conditions.

(4) Airfield Pavement: Since most airports in Vietnam were constructed a long time ago (20 to 30 years), it is presumed that pavement conditions are poor. In general, the life of asphalt pavement is 10 to 20 years with good maintenance. The past maintenance record was not available at the time of this study.

According to CAAV, weight restrictions are applied in many airports because of insufficient pavement strength. The pavement strengths of some airports are not described in AIP. It is recommended that an

evaluation of pavement strength in all airports be done using the PCN method and this evaluation be reported in the AIP so that pavement damage due to overload can be avoided.

Table 4.1.1 shows the summary assessment of main airside facilities.

Table 4.1.1
Summary Assessment of Main Airside Facilities

Airport Name	Runway Length	Runway Width	Pavement Strength
Noi Bai	1		
Cat Bi	1		
Na San			4
Dien Bien	2	3	
Vinh		3	
Phu Bai		3	
Chu Lai			4
Danang	1		
Phu Cat			4
Tuy Hoa			4
Nha Trang			4
Pleiku		3	4
Buon Ma Thuot		3	4
Tan Son Nhat	1		
Lienkhuong		3	4
Rach Gia			4
Phu Quoc	2		4
Can Tho			4
Ca Mau			4

Note: 1 Weight restriction caused by insufficient runway length.
2 Obstacles in approach and takeoff surface.
3 Insufficient runway width.
4 Pavement strength in PCN is not available.

2) Terminal Facilities

Terminal facilities consist of passenger terminal building, cargo terminal building, control tower, parking area, and access road.

(1) Passenger Terminal Building: To minimize congestion in the terminal area, necessary measures should be taken to reduce passenger processing time at check-in counters, immigrations, customs, etc.

The capacity of the existing passenger terminal building is as shown in Table 4.1.2. Detailed calculations are shown in Appendix K.

Table 4.1.2
Floor Area and Floor Area/Peak Hour Passenger

Airport Name	Passenger Terminal Building Total Floor Area [sq.m]	Estimated Capacity [Annual Pax]	Annual Total Passenger in 1998
Noi Bai *1	77,000	11,681,475	1,578,134
Cat Bi	1,942	120,828	50,814
Nasan	550	22,000	8,135
Dienbien	500	20,000	15,715
Vinh	570	22,800	11,249
Phubai	2,000	125,909	147,355
Danang	6,702	462,750	407,324
Phu Cat	500	20,000	19,302
Nha Trang	1,500	84,177	143,459
Pleiku	1,000	47,724	53,278
Buon Ma Thuot	1,380	74,905	54,140
Tan Son Nhat *2	31,000	2,210,286	3,100,797
Lienkhuong	720	30,134	38,544
Rachgia	578	23,120	10,526
Phu Quoc	700	28,969	30,230
Ca Mau	158	6,330	458

Note: *1: After completion of T1, *2: After completion of expansion of existing PTB

By comparing the estimated capacity and annual total passenger in 1998, it was found that the terminal buildings of the following airports have insufficient floor area:

- Phu Bai Airport
- Danang International Airport
- Nha Trang Airport
- Pleiku Airport
- Tan Son Nhat International Airport
- Lien Khuong Airport
- Phu Quoc Airport

A detailed study will be required to confirm this result.

In Vietnam passenger terminal buildings are constructed separately and connected only by corridors to cope with growing traffic demand. However, this may cause congestion and inconvenient flows of both passengers and vehicles in the terminal area. It is recommended that in designing buildings, future expansion must be considered. Facilities and systems for the disabled and elderly, such as slopes and elevators which are not currently provided in most terminal buildings, should be included in renovation plans.

(2) Cargo Terminal: There are cargo warehouses at Noi Bai Airport and Danang Airport, but cargo terminal facility is only available in Tan Son Nhat.

Cargo warehouses in Noi Bai are located in landside which causes the mix of landside and airside traffic. This also poses a problem for customs in the control of international air cargo. CAAV plans to convert the existing domestic terminal building into a cargo terminal after the completion of T1, the new passenger terminal building.

Because the volume of air cargo at Danang Airport has increased recently, the area of the warehouses has become insufficient.

The cargo terminal building at Tan Son Nhat International Airport is operated by a VAC subsidiary, named Tan Son Nhat Air Service Company (SASCO). The terminal has an annual handling capacity of 100,000 tons, sufficient for the current cargo demand.

(3) Control Tower: A good visibility of runway thresholds is one of the requirements for a control tower. However, its height should itself not be an obstruction to aircraft.

Data on the height and location of control towers in most airports were not available at the time of the study. Since the runway has been extended in some airports after constructing a control tower, it is necessary to confirm the tower's visibility and height.

3) Air Navigation Systems

(1) Implications of CNS/ATM for the CAAV/VATM: Due to the forthcoming introduction of the new CNS/ATM concept there is a need for considerable investment in equipment and facilities. In summary, the following will be required to meet the new procedures and air traffic management techniques:

a) Air Traffic Management: The flight plan processing systems in the ACCs at Noi Bai and Ho Chi Minh City airports and at the Approach Control Center at Danang airport will need to be upgraded or replaced.

b) Communications:
- New communications and control equipment will be required for the ACCs at Hanoi and Ho Chi Minh.
- New multimode VHF equipment will be required to provide controller-pilot and air-ground data communications, as well as digital data links for automatic dependent surveillance (ADS) at the following locations:

  - each of the VHF stations serving Hanoi ACC, HCM ACC and Danang Approach
  - each of the international airports
  - each of the domestic airports
- AFTN message switches at Hanoi and Ho Chi Minh communication centers must be replaced.

c) Navigation:
- There will be a continuing need for at least the next two years to continue installing a minimal number of conventional navigation facilities of the type that have been the mainstay of air navigation for the past four decades, namely VOR/DME, NDB and, possibly, ILS.
- For the CNS/ATM era, area augmentation systems will be required at each of the three international airports and at least three major domestic airports where final approach and landing guidance is required.

d) Surveillance:
- Three new radars will be required - one to replace the existing Russian radar in Hanoi which is already obsolete, one in the north of the country and one in the south. These should be located such that radar coverage extends to the boundaries of Vietnam's FIRs. These radars should be MSSRs with Mode S capability for cost effectiveness, in accordance with ICAO Regional Supplementary Procedures, DOC 7030. However, PSRs could be installed if considered essential.
- The existing SSRs at HCM (Qui Nhon) and Danang (Sontra) will be upgraded or replaced to provide Mode S capability.

(2) Implications of CNS/ATM for the Airlines: The Team did not have the opportunity to evaluate the equipment or techniques used by airlines for CNS/ATM. In the event that airline management is in doubt on the current status of implementation of the CNS/ATM program in the Asia-Pacific region and how it affects airlines, an outline is given below:

a) Communications:

• AMSS	Available since 1996, aircraft should already be equipped.
• HF Data	Implementation date to be determined, aircraft should already be equipped.
• VHF Data	Planned for implementation from 2000.
• SSR Mode S	Implementation commenced in 1998, aircraft should already be equipped.
• ATN	Planned for implementation from 2000.

- FANS 1 or better — Available since 1996, aircraft should already be equipped.

b) Navigation:

- GNSS+ ABAS — Available since 1996, aircraft should already be equipped.
- GNSS + ABAS + SBAS — Trials and demonstrations due for completion end of 2000 with implementation date to be determined.
- GNSS + ABAS + GBAS — Asia-Pacific implementation date to be determined. Aircraft should be equipped from 2000.

(Glossary, GNSS: Global Navigation Satellite System, ABAS: Aircraft Based Augmentation System, SBAS: Satellite Based Augmentation System, GBAS: Ground Based Augmentation System)

c) Surveillance:

- ADS — Available since 1995, aircraft to be equipped from 2000.
- ADS-B (ADS-Broadcast) — Implementation date to be determined (this is an emerging concept).
- SSR Mode S — Planned for implementation from 2000, aircraft should already be equipped.

(3) General Development of CAAV/VATM Facilities:

- Additional dual voice logging recorders are required to replace existing systems.
- The following general replacement/maintenance equipment and services are expected to be necessary:
  - an in-house calibration laboratory to standardize test equipment
  - a quantity of test equipment to replace obsolete instruments and expand capabilities
  - service contract for the flight calibration of navigation aids, minimum one visit per annum
- A regular budget equivalent to 10% of capital investment should be available to procure equipment spare parts.

(4) CATCV: The equipment and facilities of the Civil Aviation Training Center in HCMC require upgrading. Specific needs include a new ATC procedural trainer, an ATC radar simulator and a multimedia language laboratory.

(5) Site Appearance: Old airport buildings no longer in use or required should be demolished to improve the appearance of the airport and reduce obstacles. Obsolete equipment that has become redundant should also be

removed.

(6) Equipment Life: Budgetary allocations should be made to replace equipment after a period of 10 years.

4.2 Institutional and Management Aspects

1) Competitive Environment

Although there is more than one Vietnamese airline, the domestic market is dominated by Vietnam Airlines and its main competitor, Pacific Airlines, is a joint venture that is 30% owned by VAC and two companies among six shareholders are subsidiary companies of VAC.

Vietnam has pledged to move toward a free market in airline services by creating a "fair and competitive" environment for the sustained development of Vietnamese airlines, according to the statement by Nguyen Tien Sam, Director General of CAAV, at the 35th annual conference of civil aviation directors on 20 September 1999. This will place huge challenges on the Vietnamese airline industry.

However, government does not allow foreign direct investment in the air transport subsector, so the only way to tap into foreign business investment is through joint venture arrangements.

No plan has yet been developed for equitizing organizations in the air transport subsector. However, the airports have recently been established as SOEs, with the purpose of allowing them to develop related business interests such as shops, hotels, advertising, etc. A number of joint venture operations are engaged in hotel, food processing, forwarding and storage activities, but many have financial difficulties.

2) Management Information System

Information necessary for airport planning and management is insufficient and not adequately processed for use in decision-making. The financial situation of airlines and airports is not clear because financial information is not made available.

CAAV should ensure that sufficient copies of ICAO documents are obtained and circulated to the appropriate working level (It was mentioned at CATCV that it has not received such documents from CAAV.).

Some aeronautical facilities are not listed in the AIP. It is thus in need of updating and reorganizing to conform to the new ICAO format.

3) Environmental Considerations

Airports have inadequate means of dealing with sewerage and solid waste. The problem is growing and requires serious attention in view of the growing traffic levels. Although not an issue at present, the amount of noise from aircraft will grow and this will particularly affect communities around airports at Danang and Tan Son Nhat.

4) Interagency Coordination

CAAV is under the Office of Government rather than the MOT, making development of an integrated transport network and overall policy framework for transport more complicated.

The links between CAAV and VAC are very close and it is possible that CAAV has insufficient authority, in practice, to regulate VAC effectively. There is a need to strengthen CAAV's ability to plan and regulate the subsector.

Separation of the regulator and the operator is almost established between CAAV and air carriers. Three regional airport authorities and the air traffic control service provider, VATM, are state public utility enterprises. They became financially independent bodies since 1998. On the other hand, regional airport authorities and VATM belong to CAAV.

To ensure a safe, effective and economic air transportation system, the operator and the regulator must be separated. The ownership, development and operation of airports in Vietnam have been assumed almost exclusively by the Government of Vietnam. CAAV functions both as operator and regulator, hence regulatory activities have been conducted on a rather informal basis. To separate its operator and regulator roles, it is necessary to review and restructure CAAV's regulatory functions.

Moreover, there should be more cooperation between the various government departments, for example:

- CAAV and the Post and Telecommunications Department for priority restoration of telephone lines when outages occur.

Better coordination in planning facilities is essential, for example, the new Terminal 1 at Hanoi/Noi Bai Airport obscures the view from the Control Tower of a large portion of the taxiway to the Threshold of Runway 11.

At airports jointly used for civil and military purposes, improved coordination can be achieved by using only one control tower that will oversee operations for both civil and military aircraft. The tower will be manned by controllers from both sides. This

avoids problems that may occur when communications are lost between the two separate towers. The situation at Noi Bai International Airport is particularly disturbing, since during periods of joint civil-military operations, civil controllers are required to leave the civil tower and travel by car across the runway to the military tower where civil operations are re-established jointly with the military. In a military environment, this inevitably puts the civil controllers at a disadvantage (even if this is not the case), which could be detrimental to civil operations at a major international airport. At such airports, civil operations should take precedence over those of the military except in times of hostilities.

4.3 Financial Aspects

1) Airfare

Table 4.3.1 and 4.3.2 shows the comparison between airfares in Vietnam and that of regional countries.

Table 4.3.1
Comparison of Domestic Airfares of 1,000km in Regional Countries

Country	Vietnam	Vietnam	Thailand	Philippines	Indonesia	Malaysia	Japan
Route	Hanoi – Ho Chi Minh City (Vietnamese)	Hanoi – Ho Chi Minh City (Foreigner)	Bangkok – Phuket	Manila - Davao	Jakarta - Padan	Kuching – Kuala Lumpur	Narita - Kagoshima
Distance [km]	1,040	1,040	795	1105	1065	1145	1113
Local Price	1,000,000	1,900,000	2,300	-	-	-	-
Local Currency	[VND]	[VND]	[Bahts]				
Exchange Rate	14,042	14,042	0.028	-	-	-	-
Price in US$	71.21	135.31	64.4	122	272	57	148
Price per km in US$	0.07	0.13	0.08	0.11	0.26	0.05	0.13
Ratio (Vietnamese Price =1.00)	1.00	1.90	1.18	1.61	3.73	0.73	1.94
Ratio (Foreigner Price =1.00)	0.53	1.00	0.62	0.85	1.96	0.38	1.02

Note: Economy class one way full fare price, date of 20 January 2000

A comparison of the airfare cost per kilometer in the regional countries, Thailand, Malaysia, Philippines, Indonesia and Japan indicates that, for a 1,000km sector, travel for a Vietnamese citizen is cheaper in Vietnam than in Thailand, Philippines, Indonesia and Japan, and only Malaysia is cheaper. However, the airfare for foreigners traveling in Vietnam is almost double that for a Vietnamese citizen and travel for a foreigner in Vietnam is more expensive than in Thailand, Philippines and Malaysia and costs almost the same as it would in Japan.

Table 4.3.2
Comparison of Domestic Airfares of 500km in Regional Countries

Country	Vietnam	Vietnam	Thailand	Philippines	Indonesia	Malaysia	Japan
Route	Hanoi – Hue (Vietnamese)	Hanoi – Hue (Foreigner)	Bangkok – Phrae	Cebu - Davao	Jakarta - Pankalpinang	Kuala Lumpur - Langkawi	Narita - Akita
Distance [km]	549	549	544	461	522	468	519
Local Price	570,000	1,000,000	1,625	-	-	-	-
Local Currency	[VND]	[VND]	[Bahts]				
Exchange Rate	14,042	14,042	0.028	-	-	-	-
Price in US$	40.59	71.21	45.5	64	142	41	91
Price per km in US$	0.07	0.13	0.08	0.14	0.27	0.09	0.18
Ratio (Vietnamese Price =1.00)	1.00	1.75	1.13	1.88	3.68	1.18	2.37
Ratio (Foreigner Price =1.00)	0.57	1.00	0.64	1.07	2.10	0.68	1.35

Note: Economy class one way full fare price, date of 20 January 2000

Comparing the airfare cost per kilometer in the same regional countries as above for a 500km sector indicates that the cost is less in Vietnam for a Vietnamese citizen than in any of the other countries.

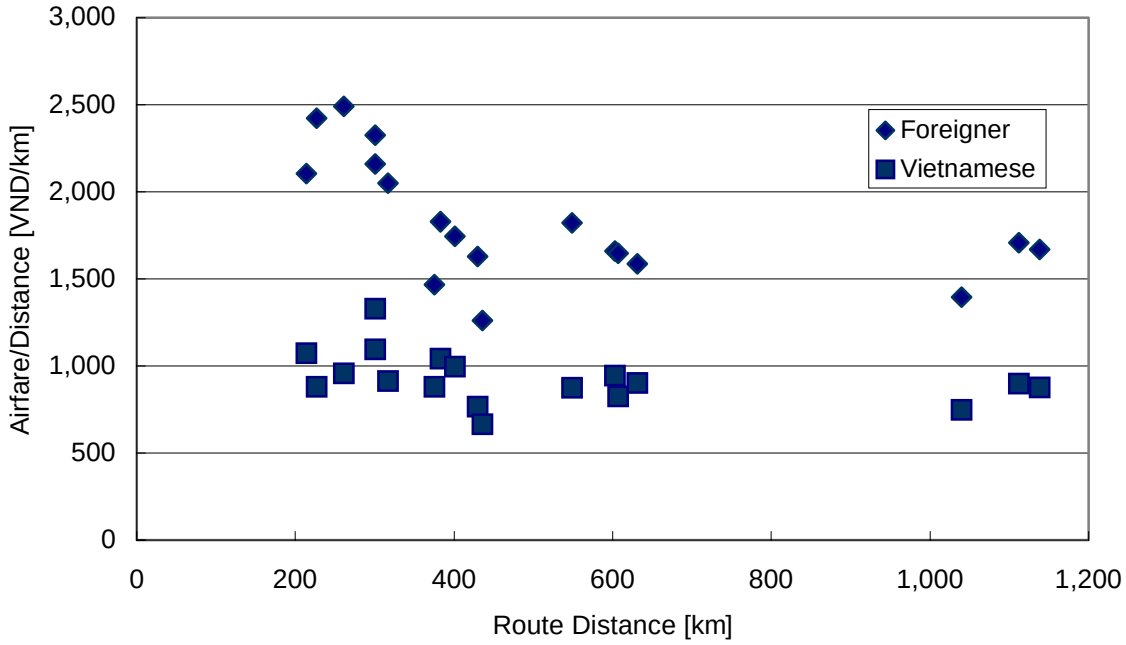
The airfare cost per kilometer remains constant in both Vietnam and Thailand for both 1,000km and 500km routes, whereas more expensive fares are applied for the shorter route in Malaysia, Philippines, Indonesia and Japan.

In general, the aircraft operating cost consists of aircraft leasing or depreciation cost, aircraft fuel cost, staff cost, aeronautical charges, ground handling, catering, etc. Most of the above costs are related to the route distance. If price per distance is set for the longer distance, airfare for short distance become cheap and airlines will face the problem that they cannot cover the cost of the operation from such cheap fares.

Figure 4.3.1 shows the relation between airfare per distance and distance.

This figure shows that airfare per distance is not much different between longer routes and shorter routes.

Figure 4.3.1
Airfare and Route Distance



4.4 Operational Aspects

Airport operations can be categorized into two – one is aeronautical operation, and the other is non-aeronautical or commercial operation.

1) Aeronautical Operation

Aeronautical operation covers services related to handling passengers, cargo and aircraft in a safe, effective, efficient, and economical manner. Air carriers provide a number of passenger, cargo and aircraft handling services in facilities and space provided by airport authorities. Airport authorities on the other hand provide rescue and fire fighting services, security, facilitation and facility maintenance.

(1) Air carriers: International services by Vietnam Airlines cover major cities in the East and southeast Asia, some European cities and two Australian cities. According to Vietnam Airlines, its share in the international passenger market from/to Vietnam accounted for 38.6%, while it had a share of 93.7% in the domestic market in 1998.

Vietnam Airlines operates 10 A320s, 3 B767-300s, 6 ATR-72s and 2 Fokker 70s. A320s are used in short haul international routes in Asia and major domestic routes between Noi Bai, Tan Son Nhat, Danang and Cat Bi Airports. B767-300s are used in long haul international routes, such as to Europe, Middle East, Japan, and Australia. ATR-72s and Fokker 70s are used in most

of the domestic routes and sub regional international flights to Lao and Cambodia.

International services by Pacific Airlines are between Ho Chi Minh City and Taipei and Kaohsiung. It operates between HCMC and Hanoi in the domestic service.

Table 4.4.1 and 4.4.2 shows annual aircraft utilization of Vietnam Airlines through 1999 to 2000 and the average annual utilizations of aircraft by the other Asian airlines.

Table 4.4.1
Annual Aircraft Utilizations

Unit: Hours

	Domestic	International	Total
B 767-300	688	4,293	4,981
A 320	1,354	1,287	2,642
ATR-72	1,345	210	1,554
Fokker 70	1,400	426	1,826

Source: Timetable of Vietnam Airlines from 4 Oct 1999 to 19 March 2000 http://www.vienamair.co.vn

Table 4.4.2
Average Annual Utilizations of Aircraft by the Other Asian Airlines

Unit: Hours

	Major Routes		
Aircraft Type	Domestic	Domestic & International	International
Jet	2,135	2,644	4,046
Turboprop	1,344	-	-

Source: IATA World Air Transport Statistics (WATS) No. 40, Average of Japan Airlines, Philippine Airlines, Garuda Indonesia and Thai Airways International. Details are shown in Appendix –L

The annual utilizations of Vietnam Airlines are close to the average of the other Asian airlines.

Table 4.4.3 shows annual available seats by each aircraft type and its estimated capacity to achieve the average load factor of 70%.

Table 4.4.3
Annual Available Seats by Aircraft Type

Unit: Seats

Items	Domestic	International	Total
Available Seats	2,258,972	1,596,709	3,855,681
Estimated Capacity	1,581,280	1,117,696	2,698,977

Source: Timetable of Vietnam Airlines from 4 Oct 1999 to 19 March 2000 http://www.vienamair.co.vn

Table 4.4.4 shows annual air passenger in 1998 and its forecast in 2000, 2005 and 2010 by Vietnam Airlines Corporation.

Table 4.4.4
Annual Passenger and Forecast by Vietnam Airlines

Year	Domestic	International	Total
Past Data			
1998	1,534,610	905,455	2,440,065
Forecast			
2000	1,872,288	937,534	2,809,822
2005	2,625,980	1,196,557	3,822,537
2010	4,040,395	1,678,234	5,718,629

Source: Vietnam Airlines Corporation

Table 4.4.5 shows the comparison between annual available seats and annual passenger in 1998 and 2000. Average load factors were estimated by comparing those figures. Estimated average load factors on domestic routes were 67.9% and 82.9% in 1998 and 2000 respectively. This indicates that the current domestic fleet matches the current traffic volume but the seat capacity needs to be expanded in near future. As compared with the load factor in domestic routes, those of international routes are low, less than 60%.

Table 4.4.5
Comparison between Available Seats and Demand

		Domestic	International	Total
Annual Available Seats in 1999 to 2000		2,258,972	1,596,709	3,855,681
1998	Annual Passenger	1,534,610	905,455	2,440,065
	Estimated Load Factor	67.9%	56.7%	63.3%
2000	Annual Passenger	1,872,288	937,534	2,809,822
	Estimated Load Factor	82.9%	58.7%	72.9%

Table 4.4.6 shows the average load factor of Vietnam Airlines flights in 1998. The average load factor of some international routes including Ho Chi Minh - Dubai - Paris, Hanoi - Dubai - Paris, Hanoi - Ho Chi Minh - Melbourne, and Hanoi – Ho Chi Minh - Sydney was more than 75% in 1998. According to the media, occupancy rate of international flights was 80-90% and that of domestic was 70% in May 1999. In general, a load factor of 60-70% is preferable for passengers to use the route efficiently with easy reservation. The occupancy rate of seats in some routes is already high, and it is expected that air carriers will face fleet shortages in these routes.

If there is no competition in air transport, air carriers tend to use larger aircraft rather than increase flight frequency to save on operational costs. This, however, is not convenient for passengers.

Table 4.4.6
Load Factor in 1998

Routes	Aircraft Type	Seat Capacity	Load Factor	Routes	Aircraft Type	Seat Capacity	Load Factor
International Routes							
SGN-DXB-CDG	B767	221	76.78%	SGN-TPE	A320	150	69.82%
HAN-DXB-CDG	B767	221	80.85%	SGN-KHH	A320	150	70.55%
SGN-HAN-MOW	B767	221	71.22%	HAN-BKK	A320	150	72.48%
HAN-SGN-MEL	B767	221	75.61%	SGN-BKK	A320	150	65.92%
HAN-SGN-SYD	B767	221	76.54%	SGN-MNL	A320	150	47.32%
SGN-KIX	B767	221	61.84%	HAN-SGN-KUL	A320	150	61.61%
HAN-HKG	A320	150	67.51%	HAN-SGN-SIN	A320	150	55.62%
SGN-HKG	A320	150	54.37%	HAN-VTE	F70	79	59.31%
SGN-HAN-CAN	A320	150	56.57%	SGN-PNH	F70	79	65.88%
HAN-TPE	A320	150	51.87%	SGN-PNH	ATR72	64	66.27%
Domestic Routes							
DAD-BMV	ATR72	64	77.05%	PXU-DAD	ATR72	64	75.20%
DAD-VII	ATR72	64	57.91%	SGN-BMV	ATR72	64	78.76%
HAN-DAD	A320	150	76.45%	SGN-DAD	A320	150	76.71%
HAN-DAD	F70	79	75.88%	SGN-DAD	F70	79	83.67%
HAN-DIN	ATR72	64	70.40%	SGN-DLI	ATR72	64	70.65%
HAN-HUI	A320	150	75.80%	SGN-HPH	A320	150	72.12%
HAN-HUI	ATR72	64	75.62%	SGN-HPH	F70	79	80.38%
HAN-HUI	F70	79	75.62%	SGN-HUI	A320	150	68.76%
HAN-NHA	ATR72	64	74.03%	SGN-HUI	ATR72	64	78.04%
HAN-NHA	F70	79	71.11%	SGN-HUI	F70	79	75.79%
HAN-SGN	B767	221	78.64%	SGN-NHA	ATR72	64	78.04%
HAN-SGN	A320	150	78.64%	SGN-NHA	F70	79	80.06%
HAN-SQH	ATR72	64	68.54%	SGN-PQC	ATR72	64	70.10%
NHA-DAD	ATR72	64	75.48%	SGN-PXU	ATR72	64	77.38%
PQC-VKG	ATR72	64	64.91%	SGN-UIH	ATR72	64	76.44%

Source: Vietnam Airlines Corporation

Ground-handling services, such as towing tractors, ladder vehicles, etc., are operated by a VAC subsidiary. The CAAV plans to liberalize ground-handling services by the year 2003. After that year, any competent company will be able to provide ground-handling services in the airport. Cargo handling is also carried out by a VAC subsidiary.

(2) Regional Airports Authorities: Regional airports authorities operate airports and provide services such as operation of the terminal building, rescue and fire fighting service, airport security, and airport maintenance.

A facilitation committee was established between CAAV, Public Security Office, Immigrations, Customs, and other relevant bodies for better airport facilitation.

Data on rescue and fire-fighting services are not available at the time of the study. From the limited information available, rescue and fire-fighting categories are less than ICAO recommendation at Phu Bai and Tan Son Nhat airports under current operations. It is recommended that enough facilities and personnel be provided to meet ICAO's required level of service for operational safety.

According to CAAV, security facilities, such as detector, baggage X-ray machine and hand scanner, are provided in all airports. However, most airports are not fully fenced because of budget constraints.

Maintenance of airside surfaces, such as grass cutting and pavement surface inspections, is implemented by airport authorities which also carry out minor maintenance of air navigation facilities in the airport. If there are difficulties in repairing navigation and communications equipment, VATM's technical department assists in solving the problems.

(3) Vietnam Air Traffic Management : VATM provides services such as air traffic control, aeronautical information services and maintenance of facilities in these services.

VATM should introduce the improvements recommended in the ICAO Civil Aviation Master Plan for the organization of the maintenance group.

2) Commercial Operation

Commercial operation refers to services that do not involve aeronautical services at airports. For this reason, it is frequently referred to as non-aeronautical operation.

Here, terminal spaces are rented to commercial enterprises, such as duty-free shops and airlines. CAAV sets the rental rates and submits these to the Government Pricing Committee for approval.

Commercial operations in most regional airports are not very active because of the current low traffic volume. Of the three international airports, Tan Son Nhat International Airport operates the largest number of concessionaires.

3) Operational Safety

All airports, particularly the international ones, should have a crash alerting system, possibly in the form of an alarm bell circuit and direct telephone line to the airport fire station. In addition, and again, particularly at international airports, fire vehicles should be equipped with VHF transceivers capable of operating on the airport and emergency VHF channels. All civil passenger aircraft registered in Vietnam should

be required to carry emergency locator transmitters (ELTs).

Moreover, the construction of security fence around regional airports is strongly recommended to restrict access to the airfield.

4.5 Human Resource Development

1) General

Discussions with CAAV indicated a need for staff training in some disciplines for which either no training facilities exist locally or the level available locally is not sufficiently advanced. The comments in this section of the report therefore refer to training overseas. The requirements are reviewed in two parts:

(1) Training required to meet the needs of the new CNS/ATM systems and techniques that will be introduced between now and 2010. This is expected to form the bulk of training needs over the next few years and early courses in these fields will necessarily be overseas, as it will take time for the Civil Aviation Training Center (CATC) to gear up to the new technologies; and

(2) The advanced training required in what may be regarded as the 'conventional', or general, aviation subjects.

Care must be taken to ensure adequate manning levels when planning training to avoid compromising operations by the absence simultaneously of too many staff at the same level.

2) Human Resource Development and Training Needs for CNS/ATM

The problem of meeting the need for trained aviation personnel has been relatively simple in the past due to the gradual evolution of the technology. CNS/ATM systems, however, are based on many new concepts and will create a major challenge to trainers. An ICAO preliminary study of the training implications of CNS/ATM has shown that:

- due largely to the increasing use of computer technology, data communications and automation, many aviation disciplines will change due to the introduction of CNS/ATM technologies;

- some aviation disciplines will disappear and be replaced by new ones in the transition from ground to satellite-based technology with the consequent need for redeployment and retraining of staff; and

- in the transition phase, the training and course development needs will be

particularly high with the training in the new technologies, equipment and procedures. Also, sufficient qualified personnel must remain proficient in the skills to maintain and operate the obsolescent systems.

Training needs for CNS/ATM fall into three principal categories:

- Foundation training, in fundamentals of automation, digital communications, satellite communications and computer networking;

- Training for implementation planners, to provide decision makers with the basic knowledge to plan: -the implementation of CNS systems; and

- the ATM operational aspects of the systems.

- Job-specific training, to train personnel to manage, operate and maintain the systems on a continuing basis. This will represent most of the training necessary and also be the most difficult to design and execute.

Training in the first two categories mentioned above should be implemented as soon as possible. They are described in more detail below, together with an outline of a long-term strategy for development of the job specific training for management, operation and maintenance of CNS/ATM systems on a continuing basis.

(1) Foundation Training

Some additional foundation or prerequisite training to that normally provided in CATCs will be necessary, eg:

- CNS/ATM systems
- digital communications
- computer fundamentals
- computer communications, including local/wide area networks
- satellite communications systems for fixed and mobile services
- satellite navigation systems
- automation implications
- fundamentals of ATM
- aeronautical data bases.

(2) Training for Implementation Planners

(a) Training for CNS Systems Implementation Planning: Until now, communications, navigation and surveillance systems have mostly been planned, implemented and operated on a national basis. The new CNS/ATM systems, however, are usually planned and implemented at global or regional level because of their nature. Regional groups or

commercial service providers can execute regional implemention and a State could buy CNS services to reduce local implementation of systems.

Thus, technical management personnel of a Civil Aviation Administration will need to be familiar with major functions and features of CNS systems, as well as the implementation, leasing and purchasing options available. Only then will they be capable to evaluate the options in collaboration with the ATM staff and jointly decide their transition strategy. The training for these staff members should therefore provide an overview of the following CNS systems:

- Communications: AMMSS, VDL, SSR Mode S datalink, HF datalink and ATN;
- Navigation: GPS, GLONASS and the various augmentation systems;
- Surveillance: SSR Modes A, C and S, ADS and ADS-B; and
- relevant organizational, economic, certification and operational matters.

(b) Training for ATM Operational Implementation Planning: Senior operational managers responsible for planning transition to the new CNS/ATM systems will need an overview of the fields listed above. In addition, operational managers will need the following training:

- traffic forecasting and cost/benefit analysis;
- air traffic management, including:
- airspace planning;
- air traffic flow management (ATFM) systems and procedures;
- air traffic services systems and procedures; and
- ATM-related aspects of flight operations;
- CNS/ATM transition and implementation project planning;
- human resource planning and training matters;
- issues related to the increased use of automation in the new systems; and
- operational and quality control issues associated with aeronautical data bases.

As existing systems will continue to operate in parallel with the new systems for a period, human resource planning and training will be a major challenge during the transition.

Many air traffic control functions previously tackled manually will be automated with the CNS/ATM systems. Operational planners will require a full understanding of automation implications and backup procedures available in event of system malfunctions. Such implications are also important during job specific training for staff who will operate CNS/ATM systems.

(c) CNS/ATM Job-specific Training - A Long Term Strategy: Aviation training is the responsibility of the State although ICAO does encourage mutual assistance between States, particularly through its TRAINAIR Programme.

Until now, each State's CATC independently organized training programmes for conventional air navigation systems. With the major changes in civil aviation jobs related to CNS/ATM and the resulting training requirements, it is unlikely that CATCs working alone will be able to develop all the training programmes necessary for prompt implementation of CNS/ATM systems. Independent development of course materials could also defeat the ICAO goal of standardizing all the elements of the training. A coordinated, cooperative approach towards CNS/ATM training development will help to expedite formulation and standardization of the training and also be more efficient insofar as it will help prevent duplication of effort that has occurred in the past. The strategy outlined below consists of three basic elements and is designed to expedite international cooperation in the development of CNS/ATM training. These elements are:

- Early identification of CNS/ATM training needs and priorities: In view of the vast amount of training to be developed and the need for standardisation, it is crucial that a plan be established for cooperative development of the required course materials. However, to achieve this effectively and cost-efficiently requires identification of training needs and priorities;
- Coordination of planning of CNS/ATM training development at the regional level: The planning and coordination in development of CNS/ATM course materials should be carried out at regional level through appropriate existing planning structures. Cooperation is particularly important in the development of specialised courses where trainee numbers do not justify their implementation in each State's national training centre; and
- Widest possible participation in the ICAO TRAINAIR programme by States: Programme for the enhancement of civil aviation training are provided in the following sections.

The first two strategies described above will be addressed through an ICAO initiative under which its Air Navigation Commission (ANC) is analysing regional human resource planning and training needs. An objective of this task is to analyse the changes to civil aviation job profiles as a result of the new CNS/ATM systems, and the consequential human resource planning and training requirements.

(3) Regional Human Resource Planning and Training Needs

Guidance material to be produced from the IACO ANC task referred to above will contain two major outputs:

- A human resource planning tool for use by States, comprising tables or a computer programme to assist in determining current and future staffing needs; and
- A model for planning regional training capabilities, which will provide a systematic approach for analysing human resource plans, determining the needs for national and/or regional training capabilities and documenting the results.

(4) Sources of Training

The existing ICAO Training Directory lists training courses offered globally and now identifies those which contain CNS/ATM content. The new document under preparation by the ICAO ANC will provide more detailed information on current and planned CNS/ATM training capabilities available in the Regions.

CNS/ATM systems training programmes are also being developed by those CATCs which are members of the TRAINAIR Programme. 'Standardised Training Packages' (STPs) are developed by members using the TRAINAIR development methodology and members can obtain STPs prepared by other members for only the actual cost of reproduction plus postage.

TRAINAIR membership is open to all government-operated CATCs providing certain conditions are met, including that the centre establishes and maintains a Course Development Unit dedicated to the preparation of STPs to TRAINAIR standards. The cost of establishing of such a Unit at a national CATC may be funded through an ICAO technical cooperation project.

(5) Human Resource Development During Transition

The main functions of human resource development are to assist organizations to cater for change, adapt to new requirements and achieve necessary levels of human performance to meet that change. The transition to CNS/ATM systems represents a significant change and, to meet it, human resource development managers must review organizational structure, plan required human resources, review selection criteria for new staff and plan for development of new training programmes.

The regional/global nature of CNS/ATM systems may demand changes in organizational structure of service providers to adapt to the new conditions. Changes in job profiles, elimination of some obsolescent disciplines and creation of new ones appropriate to the new systems may also affect organization.

The aim of human resource planning is to provide the right number of staff at the right time with the right skills. Because of the lead time required to train personnel, a training demand forecast is an essential factor in preparing a training programme.

In planning for CNS/ATM, planners should therefore consider the following factors:

- several disciplines will no longer be required once the CNS/ATM systems are fully implemented;
- new disciplines will result from the implementation of the new systems;
- most staff in existing jobs will require additional training for the new systems;
- old and new systems will operate in parallel for a period pending full introduction of the new systems; and
- increased use of automation will demand training in this field.

Human resource plans should project needs for at least five years ahead. When available, ICAO's new guide-lines mentioned above should be helpful in this area.

Human resources and training requirements will require close attention during the transition period. In particular, careful planning will be necessary to ensure operation of old and new systems in parallel, coupled with a progressive transition in which some disciplines will be eliminated and others created.

Training needs will peak during the transition period as existing personnel will be under training during this period. Their time spent in training can have a significant effect on human resource plans. Planners must therefore consider this factor as staffing will have to be adjusted during this period to cater for those personnel in training or acting as trainers.

If not in progress already, human resources planning and training for CNS/ATM should commence now. It should begin with a staff audit for current needs and a projection for the next five years as these are essential for determining future human resource plans.

Selection criteria for new staff jobs should be reviewed as part of the State's transition planning. New technologies will require new skills - the most cost-effective way is to select new recruits with appropriate aptitudes, skills and previous education.

In developing suitable training for automated systems, it is necessary to determine how much a trainee needs to know about the underlying automation technologies in order to use the system safely and efficiently.

Distance learning techniques could be used for some of the training - especially for those trainees with the prerequisite skills for job-specific training.

Implementation of increased levels of automation represent a major innovation to many personnel and some experienced personnel may be resistant. This resistance may alleviated by initiating foundation training in computers and automation at an early date.

(3) General Fields of Training

(a) Business and Planning: There is a need for familiarization with operations in a market-oriented economy, together with knowledge of the techniques required for the supervision of large projects. Also there appears to be little appreciation of the need for cost/benefit analysis prior to embarking on new projects.

To reinforce the capabilities in these fields of civil aviation, training is recommended in the following disciplines:
- business management (to Master's level);
- planning supervision (or 'oversight'); and
- project management.

(b) Safety Aspects: Safety is an important aspects of civil aviation and improvements are always evolving. Staff responsible for this aspect must therefore remain current with the latest developments. Civil/military coordination is a function of air traffic management, it is mentioned here in connection with air safety as a hazardous situation could arise at Noi Bai International Airport when, on occasions of joint use of the airport, civil controllers are required to leave the civil tower and cross the runway to operate from the military tower.

Training is considered necessary in the following areas:
- safety oversight (through the ICAO two-week Course);
- technical standards; and
- civil/military coordination.

(c) Air Transport: There is a trend towards increasing liberalization of civil air transport globally and ASEAN is proposing that its Member States introduce 'open skies' policies in the course of the next 2 years. This will result in the need for major reviews of air transport agreements, route structures, tariffs and schedules.

To cater for the new developments in air transport, training is recommended in the following disciplines:
- air transport planning; and

- air transport management.

(d) Human Resource Planning and Training: The introduction of CNS/ATM systems and techniques will have a profound effect on human resource planning and training. These matters have been discussed at length earlier in this section of the report and, suffice to state at this point is that, to reinforce capabilities in these fields, training is recommended in the following:
- human resource planning;
- management of training; and
- English language training (to Master's level).

(e) Airports: It was noted that some developments were being undertaken without a feasibility study, cost/benefit analysis or master plan. There appeared to be a general lack of appreciation for such preliminary studies and considerable funds were being committed without proper consideration. Airport managerial staff would benefit from refresher training and environmental standards at airports require improvement. Reinforcement of the capabilities in these areas is recommended through training in the following:
- airport planning;
- airport architecture;
- environmental standards;
- airport management - technical; and
- airport management - operations.

Persons intent on smuggling weapons and explosives onto aircraft are always devising new methods of evading scrutiny. It is important that aviation security staff are familiar with the latest techniques available to assist them in their task and always maintain vigilance.

Although considerable improvements have been made in the facilitation of passengers, some procedures remain irksome. Particularly so is the need for passengers, after collection of their baggage from the carousel, to unload bags from their trolleys for customs X-ray and reload them to exit the terminal.

(f) Other Areas: Additional training should thus be provided in the following fields:
- aviation security; and
- facilitation.

5 DISCUSSIONS ON STRATEGIC ISSUES FOR AIR TRANSPORT DEVELOPMENT

5.1 Goals and Objectives

As globalization of economies makes further progress, international competition and exchange of information become more significant and, with the expansion of tourism, the role of air transport will become much more important in the future, demanding much better quality of services both internationally and domestically.

Long-term objectives of the aviation sub-sector are as follows:

(1) To establish a hierarchical airport network in the country to enable the configuring of an effective international and domestic air transport network.

(2) To expand the international air transport network to link with major destinations in the world, especially with those in neighboring countries, the Mekong sub-region, ASEAN and regional hubs and the major economies.

(3) To develop an effective domestic air transport network to strengthen high value transport services between growth centers and tourism destinations, at the same time, to provide remote areas with necessary social and administrative services.

(4) To develop the air traffic management system, using modern technology that meets international requirements.

(5) To strengthen national airlines and make them independent, commercial enterprises to provide better services as well as to be more competitive in the more liberalized international air transport.

(6) To commercialize airport and related services in order to meet user needs at least cost

(7) To strengthen capacity to regulate the aviation sector in order to enhance competition whilst ensuring minimum international safety standards.

5.2 Airport Network and Air Transport Routes

1) General

The possibility of constructing new airports is discussed in this section. Firstly, it was evaluated based on the potential air passenger traffic. Secondly, the CAAV policy for new airports was evaluated, before the VITRANSS made its recommendations for new airports.

2) Potential Air Passenger Traffic

Potential air passenger traffic between provinces in 2020 was assuming that an airport is located in each province.

After calculating the potential traffic by route, screening was carried out based on the following assumptions:

- Air traffic route becomes feasible if there is traffic demand for more than one turboprop aircraft operation per day (minimum of 48 persons a day).[1] For stable regular air services, it is assumed that one aircraft operation a day is the minimum.
- Minimum air route distance is 200 km.[2]

After the above screening process, total potential air passenger traffic was calculated for each province in terms of generation and attraction by summing up the passengers by route.

The results are shown in Table 5.2.1. It is obvious that most provinces have a potential to support an airport. However, it is neither practical nor feasible to construct one in all the provinces with more than the threshold potential (probably 100-300 passengers a day).

[1] 40-seat aircraft is assumed: (40 seats) x (60% load factor) x 2(arrival and departure) = 48
[2] Existing shortest air route is from Noi Bai Airport to Nasan Airport, with a distance of 190 km. Second shortest air route is from Tan Son Nhat Airport to Lienkhuong (Dalat) Airport at 214 km.

Table 5.2.1
Potential Air Traffic Passenger, 2020 (Generation and Attraction)

Province	Existing Airport	Pottential Passenger /day Pax/day	Rank
1 Hanoi	X	16,522	2
2 Haiphong	X	1,046	6
3 Hai Duong		200	32
4 Hung Yen		130	43
5 Thai Binh		183	39
6 Nam Dinh		306	22
7 Ninh Binh		184	38
8 Ha Nam		188	35
9 Ha Tay		369	19
10 Cao Bang		259	30
11 Lang Son		130	43
12 Quang Ninh		638	9
13 Thai Nguyen		199	33
14 Bac Can		109	56
15 Bac Ninh		185	37
16 Bac Giang		124	47
17 Phu Tho		197	34
18 Vinh Phuc		120	50
19 Lao Cai		287	28
20 Yen Bai		125	46
21 Tuyen Quang		122	48
22 Ha Giang		111	54
23 Son La	X	260	29
24 Lai Chau	X	182	40
25 Hoa Binh		128	45
26 Thanh Hoa		506	13
27 Nghe An	X	420	18
28 Ha Tinh		186	36
29 Quang Binh		295	26
30 Quang Tri		180	41
31 Thua Thien-Hue	X	556	11
32 Quang Nam		294	27
33 Danang	X	3,621	3
34 Quang Ngai		297	24
35 Binh Dinh	X	423	17
36 Phu Yen	X	302	23
37 Khanh Hoa	X	673	8
38 Kon Tum		180	41
39 Gia Lai	X	312	20
40 Dac Lac	X	489	14
41 Ho Chi Minh	X	19,349	1
42 Lam Dong	X	428	16
43 Ninh Thuan		296	25
44 Binh Phuoc		50	61
45 Tay Ninh		109	56
46 Binh Duong		460	15
47 Dong Nai		1,624	5
48 Binh Thuan		112	53
49 Ba Ria-Vung Tau		3,284	4
50 Long An		122	48
51 Dong Thap		111	54
52 An Giang		239	31
53 Tien Giang		118	51
54 Vinh Long		107	59
55 Ben Tre	X	108	58
56 Kien Giang		752	7
57 Can Tho		591	10
58 Tra Vinh		53	60
59 Soc Trang		114	52
60 Bac Lieu		308	21
61 Ca Mau	X	530	12

The following provinces were identified to have a large potential air traffic demand:

- Quang Ninh
- Binh Duong
- Dong Nai
- Ba Ria - Vung Tau
- An Giang
- Can Tho

The possibility of new airports in these provinces was briefly evaluated as follows:

- Quang Ninh, Binh Duong, Dong Nai, Ba Ria - Vung Tau, and An Giang are close to existing airports.
  Quang Ninh – Cat Bi Airport (30 km)
  Binh Duong – Tan Son Nhat International Airport (30 km)
  Dong Nai – Tan Son Nhat International Airport (20 km)
  Ba Ria - Vung Tau – Tan Son Nhat International Airport (60 km)
  An Giang – Rach Gia Airport (60 km)
  If the road networks between these provinces and the existing airports are improved, new airports will not be required.
- Can Tho is located approximately 120 km from Tan Son Nhat Airport and approximately 80 km from Rach Gia Airport. There are some plans to improve the road and rail connection between Can Tho and Ho Chi Minh City. If these plans are implemented, a new airport will not be necessary.

3) New Airport Plan by the CAAV

The influence, or catchment, area of each airport was assumed to be at 100 km radius from the airport. Figure 5.2.1 shows the existing and planned airports by the CAAV, and the influence areas of each existing airport.

From this figure, it is obvious that the influence area of airports does not cover the northern mountainous area where the road network is also not well developed. If new airports are constructed, the transportation system in this area will be improved.

The influence area of airports also does not cover the north central coast. Vinh Airport is the only airport in the area between Noi Bai Airport and Phu Bai Airport.

Meanwhile, there are more airports in the south than in the north, and most of the area is under the influence area of an airport.

The CAAV plans to develop new airports in the following provinces:

- Cao Bang
- Lao Cai
- Thanh Hoa
- Quang Binh (Dong Hoi)
- Quang Nam (Chu Lai)

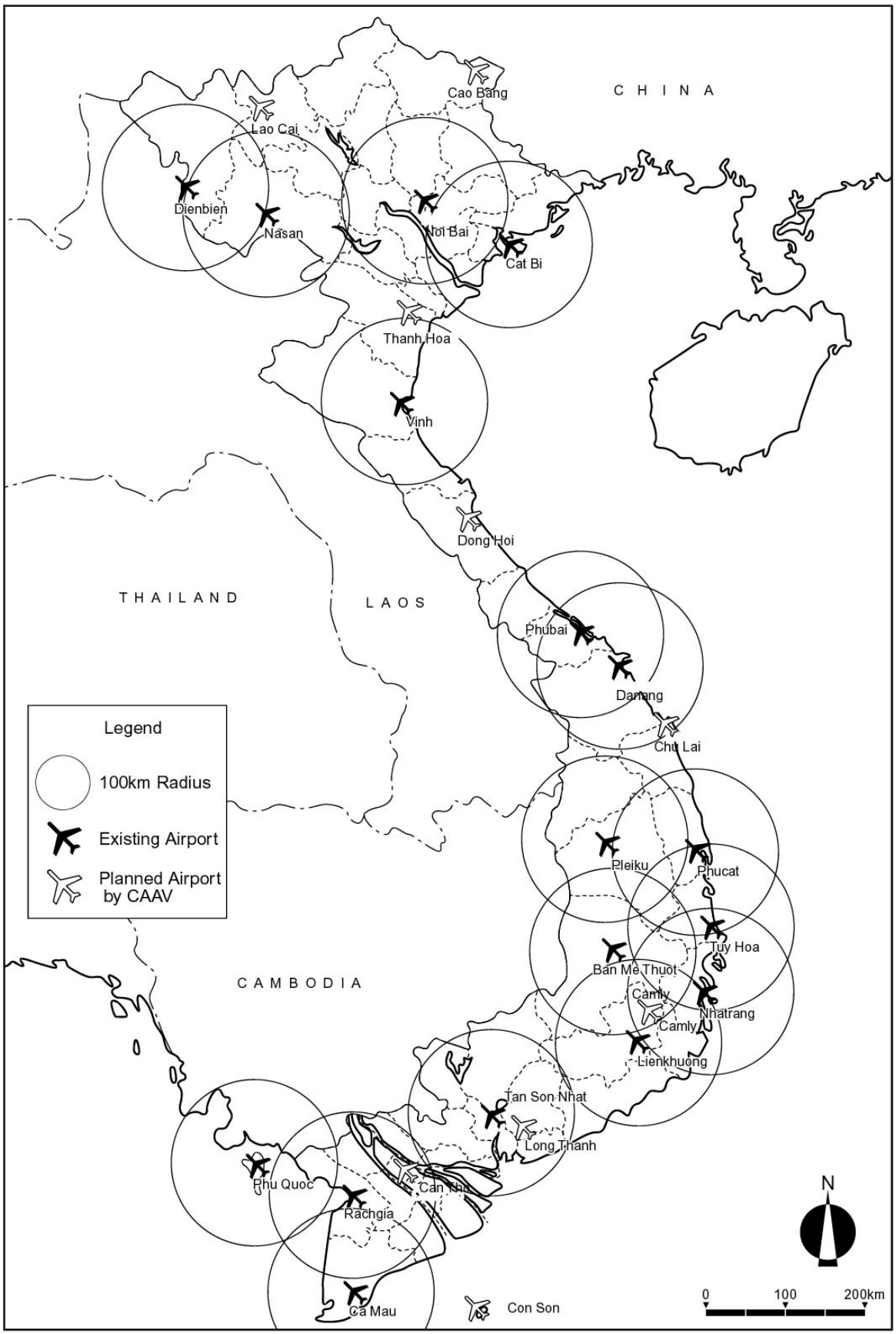
- Lam Dong (Camly)
- Ba Ria - Vung Tau (Con Son Island)
- Can Tho
- Dong Nai (Long Thanh)

The possibilities of new airports were evaluated as follows:

(1) Cao Bang and Lao Cai provinces are located in the mountainous area. Since these provinces are more than 100 km away from existing airports, airports will help the transportation of the people in this area.
(2) Thanh Hoa and Quang Binh provinces are more than 100 km away from the closest airport. Potential air traffic in these provinces is 506 and 295 passengers daily, respectively (Table 5.2.1). Considering the development project of other transportation modes, connection by road between Vinh and Hanoi will be improved in the near future so that a new airport will not be necessary in Tanh Hoa.
(3) Chu Lai in Quang Nam province, 90 km from Danang International Airport, has an old military air base. According to the 1997 JICA Study[3], the old airport can be developed with a relatively small investment.
(4) Lam Dong province has the Lien Khuong (Da Lat) Airport, which is approximately 25 km from the old Cam Ly Airport. Thus another airport will not be required here.
(5) Con Son in Ba Ria - Vung Tau province is an island with an old airport. It is possible to promote tourism in this island. An airport will contribute in improving the connection between the islands and the mainland.
(6) There is an old airport in Can Tho where the potential air transport demand is 591 passengers daily, which is higher than that of other provinces. This airport can be utilized with a relatively small investment though, as mentioned in the previous section, there are many improvement plans for land transportation between Ho Chi Minh City and Can Tho.
(7) Long Thanh Airport in Dong Nai province is planned to be a substitute airport after Tan Son Nhat International Airport reaches its capacity. The capacity and future demand of Tan Son Nhat International Airport should be studied in detail to determine whether Long Thanh Airport is required in the future.

[3] "The Study on the Integrated Regional Socio-Economic Development Master Plan for the Key Area of the Central Region of the Socialist Republic of Viet Nam", Japan International Cooperation Agency, March 1997

Figure 5.2.1
Existing and Future Airports



4) Development Potential for New Airports

Based on the foregoing, the following provinces, where currently there is no civil airport, are considered to have the potential for a new airport:

- Cao Bang — New airport
- Lao Cai — Improvement of old airport
- Quang Nam (Chu Lai) — Improvement of old airport
- Quang Binh (Dong Hoi) — Improvement of old airport

5) Future Air Transport Network

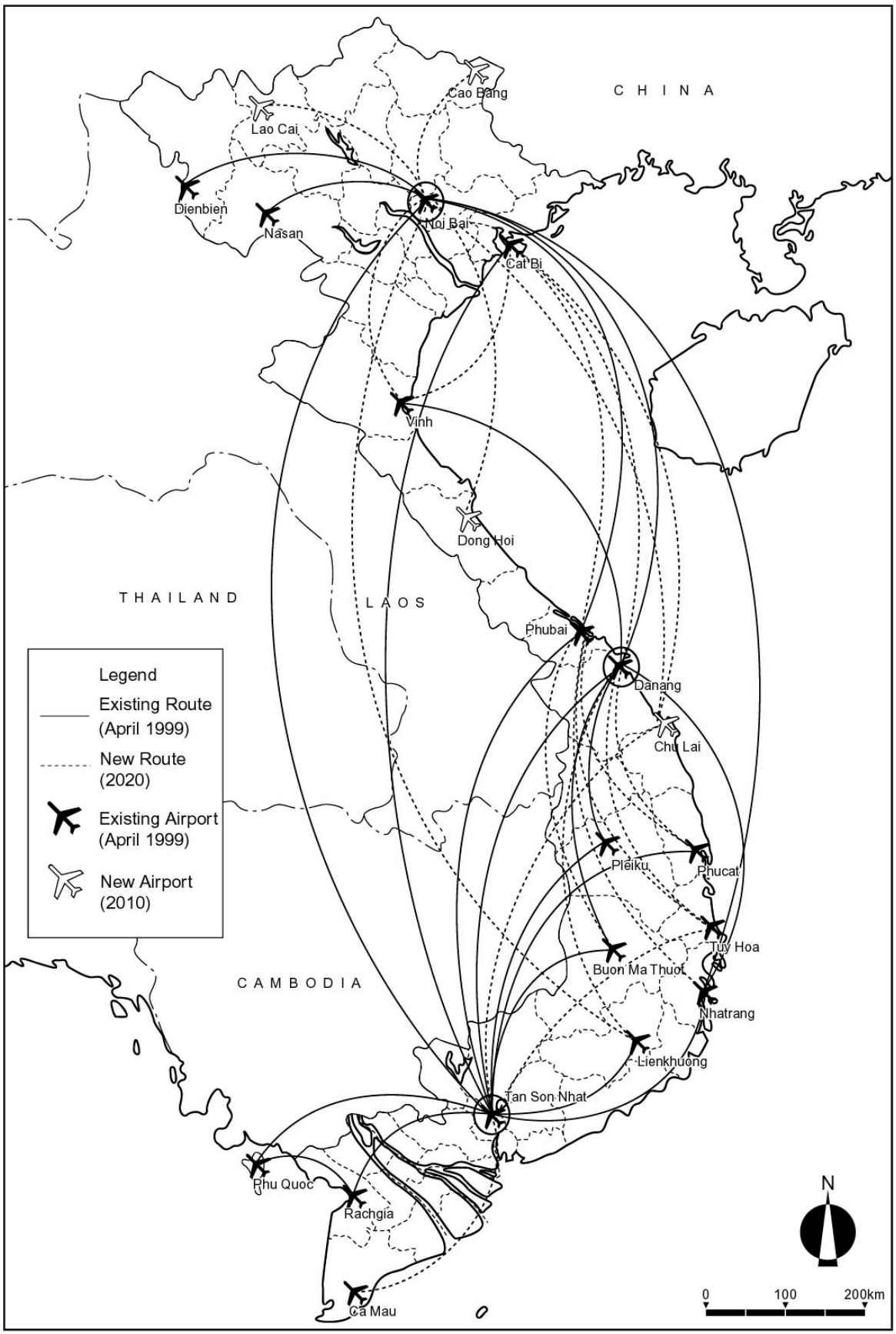
The three international airports of Noi Bai, Danang and Tan Son Nhat will play the role of domestic hub airports. Air routes will connect these hubs to regional airports. This hub-and-spoke concept will be basically applied in the North and the South similar to the current situation.

Air routes to/from two hub airports, Noi Bai Airport and Danang Airport, will be provided for airports in the North Central Coast. While air routes to/from Danang and Tan Son Nhat will serve the airports in the South Central Coast, the Central Highland and the Southeast.

Many new routes are to be operated from Cat Bi and Phu Bai airports to the other regional airports and Cat Bi and Phu Bai airports will be trunk line airports. These airports will be connected to all three hub airports. The future domestic air transport network in 2020 is shown in Figure 5.2.2.

Liberalization in air transportation is a global trend. Cambodia, Laos, Myanmar, and Vietnam have established a sub regional air transport cooperation agreement. By this agreement, it is expected that flights between the cities in this sub region will increase in the future. Liberalized air transport policies will be introduced in the sub region and expanded to the ASEAN and APEC.

Figure 5.2.2
Future Domestic Air Network



6) Result of the Future Air Traffic Demand Forecast by Airport

The air traffic demand up to 2020 was calculated and the results are shown in Table 5.2.2.

Table 5.2.2
Future Air Traffic Demand

	Domestic Passenger				Domestic Cargo [ton]			
Airport Name	1998	2010	2015	2020	1998	2010	2015	2020
Noi Bai	1,028,706	3,383,550	4,762,520	6,075,790	19,736	21,170	27,010	32,850
Cat Bi	50,814	204,400	280,320	324,120	1,385	2,920	4,380	5,840
Cao Bang	0	0	20,075	23,360	0	0	0	0
Lao Cai	0	0	22,265	26,280	0	0	0	0
Nasan	8,135	18,980	22,630	26,280	26	0	0	0
Dienbien	15,715	29,930	36,865	43,800	88	0	0	0
Vinh	11,249	40,880	69,350	81,030	65	0	0	0
Dong Hoi	0	0	22,265	26,280	0	0	0	0
Phubai	147,355	246,740	319,375	415,370	2	0	0	0
Chu Lai	0	0	88,330	101,470	0	0	0	0
Danang	407,324	1,324,220	1,620,235	1,882,670	2,733	4,380	5,110	5,840
Phucat	19,302	27,448	47,888	70,080	0	0	584	1,168
Tuy Hoa	1,576	0	11,972	17,520	0	0	146	292
Nha Trang	143,459	197,830	250,755	288,350	1	0	365	730
Pleiku	53,278	77,380	89,790	102,200	0	0	0	0
Ban Me Thuot	54,140	97,090	116,070	154,760	345	0	0	0
Tan Son Nhat	1,308,791	3,740,104	5,110,223	6,413,619	21,432	54,436	62,831	71,226
Lienkhuong	38,544	43,800	61,320	81,760	288	730	730	730
Rachgia	10,526	12,286	14,093	15,899	76	0	241	482
Phu Quoc	30,230	37,230	42,705	48,180	324	0	730	1,460
Ca Mau	458	0	37,230	42,340	0	0	365	730
Total	3,329,602	9,481,868	13,046,275	16,261,159	46,502	83,636	102,492	121,348
	International Passenger				International Cargo [ton]			
	1998	2010	2015	2020	1998	2010	2015	2020
Noi Bai	549,428	1,915,000	2,563,000	3,447,000	9,853	48,701	65,181	87,662
Danang	0	383,000	718,000	1,378,000	0	9,740	18,260	35,045
Tan Son Nhat	1,792,006	5,362,000	6,973,000	8,962,000	49,693	136,363	177,333	227,916
Total	2,341,434	7,660,000	10,254,000	13,787,000	59,546	194,805	260,774	350,623

Source: VITRANSS

Number of total domestic and international passengers will increase to approximately 5 times and 6 times respectively by 2020 compared with those of 1998.

5.3 Planning Aspects

1) Prioritization of Development Projects

There has been a strong requirement to improve infrastructure to meet current and future demands and to improve operational safety. However, available funds are limited. Public funds should be used for projects that have the highest social values. To efficiently use limited funds, CAAV should establish adequate criteria for prioritizing development projects, which meet local conditions.

There are several methods for prioritizing the projects such as, facility sufficient index (FSI), social cost benefit analysis and others.

Social cost benefit analysis is used in many public investment projects in the world and is the one used in Vietnam. Its objective is to determine a project's impact on the national economy. It examines how efficiently national resources are allocated by means of the project and how superior the project is in comparison with other competing projects. Any type of project can be compared by this analysis. Its disadvantage, however, is that it is a complicated method and the index only shows the economic efficiency.

FSI represents a rate for the facility size against the required capacity of that facility and system. The advantage of FSI is that it is easy to understand, can be computed relatively easily and can be used to compare the development conditions. The disadvantage is that it can only be used for development projects of existing facilities and systems, because the FSI of a new airport project and new facilities is always 0%.

2) Master Plan, Phased Development Plan and Five-year Program for Developments

It is very important to totally elaborate and clarify a decision on a development. It is strongly recommended that a national master plan, individual airport development master plans and air navigation system master plans be prepared.

The phased development plan is suitable for planning facilities to meet the increases in air traffic volume. It is a common practice in airport planning. The development plan is divided in three phases, short term, medium term and long term to cover a 20- to 30-year planning. The facilities are planned to be usable for five years after completion without major improvements and to allow future expansion.

In this study, the target year for short term, medium term and long term development plan is 2005, 2010 and 2020, respectively.

A five-year development program is recommended to steadily implement a

development project dependent on the financial basis. This program has to be monitored for unexpected changes in socio-economic conditions.

3) Consultation and Coordination with Users

A variety of users, such as air carriers, passengers, air traffic service providers, airport operators, etc, are related to air transport. Consultation with these users should be made in planning for more efficient design.

Particularly, airports should be planned for various functions to be integrated into one single system. After the separation of regulator and operators in the air transport subsector, many facilities, such as passenger terminal building, control tower, cargo terminal building, maintenance hangar, airport hotels, etc., may be planned and constructed by many different organizations. CAAV will be required to act as coordinator among air carriers, air traffic service providers and airport operators.

4) Establishment of National Technical Standards

A common set of technical standards will ensure the safety of air transport and also save investment capital and operating costs. This can be achieved by reviewing and analyzing ICAO standards and recommended practices, Federal Aviation Administration guidelines, JCAB standards, etc., which CAAV has already done to some extent.

National technical standards will also help to design airport facilities to suit local conditions. As a example, some of the JCAB standards are applied for facility requirements in this study as shown in Appendix M. JCAB standards have been prepared to consider the local conditions in Japan by collecting information on peak hour passenger ratio, peak day passenger ratio, aircraft occupancy time in apron, parking area requirement, among others.

The following standards and guidelines are used by the JCAB for airport engineering:

(1) Airport Planning
- Airport Facilities Planning Guideline

(2) Airport Design
- Airport Civil Facilities Planning Manual
- Airport Pavement Design Manual
- Airport Drainage Design Manual
- Airport High Embankment Design Guideline

(3) Airport Construction
- Airport Civil Construction Standard Specification

(4) Airport Maintenance
- Airport Pavement Maintenance Manual

Within the framework of these widely accepted standards, it is recommended that CAAV establish national technical standards which reflect local conditions in Vietnam.

5) Airport Classification

An airport classification system has not been used in Vietnam for airport planning purposes. In general, airport classification can be determined in terms of ownership, passenger throughput levels, types and sizes of aircraft, and function within the entire airport system.

The VITRANSS proposes an airport classification system by function and aircraft size operated in the airport. Airport classification will help to prioritize airport projects and simplify and guide airport planning, as follows:

(1) Primary Airport “International Airport”

Primary airports will be able to accommodate not only domestic and regional flights but also long-haul international flights. Airports in this class serve as gateways to Vietnam and regional hubs for domestic routes. Airport facilities will be designed to accommodate large jet aircraft.

(2) Secondary Airport “Trunk Line Airport”

Secondary airports are regional trunk line airports. These airports will be connected to all Primary airports by direct routes. Airport facilities will be designed for medium-size jet aircraft.

(3) Tertiary “Regional Airport”

Tertiary airports are for regional domestic airports. These airports will be connected to a Primary airport. Airport facilities will be designed for small jet aircraft or turbo prop aircraft.

6) Air Navigation Plan

(1) Financial Aspects

CAAV and VATM will need to develop financial goals for the introduction of CNS/ATM. To determine these goals, some of the following studies may need to be undertaken:

a) Air Traffic Statistics: Detailed air traffic statistics should be regularly compared with air traffic forecasts to determine changes in demand so that CAAV and VATM may review their organizations and make necessary changes to maintain cost efficient operations.

b) Air Traffic Forecasts: Rational traffic forecasts are essential to any transport infrastructure development and financing. The purpose of such forecasts is to identify traffic developments and establish the associated capacity requirements of facilities or services. Forecasts are the bases for financial and economic analyses which can be used to determine revenue estimates from charges on air traffic.

c) Financial and Economic Analyses: Major investment decisions should be supported by analyses to demonstrate costs and benefits to service providers and users. These analyses are important when choosing between options for implementation of CNS/ATM systems and for seeking financing, especially from outside sources. The following types of analysis may be required:
   - a financial study to determine direct costs, revenues and sources of funds,
   - a cost/benefit analysis to determine the economic viability of a proposed project and
   - socio-economic impact analysis to determine the broader contribution of the project to the economy and society as a whole.

d) Financing Plan: Based on the information from the traffic forecasts and various analyses, a financing plan can be prepared. Its purposes are to:
   - provide cost estimates for each element of the total project,
   - decide the funds required and program their allocation,
   - determine the currencies necessary to procure the elements of the project, and
   - decide the sources of the funds.

e) Sources of Financing: Experience in other countries suggests that virtually all of the investment in the aviation subsector can be financed from user charges for services provided - transport fares and tariffs, airport and air traffic management charges. Indeed, in Vietnam, there is evidence that substantial operating surpluses are generated for both airports and air traffic management (part of the latter being attributable to revenue earned from the significant number of international flights crossing Vietnamese airspace).

   If CAAV is unable to provide funds from its own resources, where required (for example, for the financing of equipment required for CNS/ATM), it should investigate possible alternative sources. These may include direct contributions from central government, debt financing, equity financing or leasing of systems, circuits or equipment.

(2) Master Planning

Based on the foregoing, CAAV and VATM should establish a long-term plan to cover the air navigation system for the period 2000 to 2020. The Master Plan for 2000 to 2010 proposed in this report could be used as a basis for the first 10 years. It is important that the air navigation service has a regular annual budget to meet its objectives and obligations to its users.

Progress should be reviewed frequently against the Master Plan, which should be modified as necessary to cater to changes in traffic shift, emerging technologies, newly developed ICAO standards and recommended practices, etc.

In 2005, a new master plan should be developed for the period 2010-2020.

(3) Regional Cooperation for CNS/ATM Policy

It is essential that CAAV and VATM maintain close dialogue with neighboring states in the Asia-Pacific region and with ICAO to ensure that CNS/ATM systems and procedures in Vietnam are developed in collaboration with its neighbors.

Discussions with neighboring states should center on the possibility of cooperation with respect to establishing joint-use facilities for CNS/ATM.

Coordination with ICAO may be achieved through participation in ICAO meetings (especially those relating to CNS/ATM) and through close contact with its Asia-Pacific Regional Office in Bangkok, specifically the Asia Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG).

The participation of CAAV and VATM in CNS/ATM meetings arranged by other organizations, such as IATA, IFALPA, civil aviation administrations of other states, related organizations and systems manufacturers, would also be beneficial.

5.4 Organization and Management Responsibilities

1) General

In order to complete the Government's program of separating business and regulatory oversight responsibilities in the aviation sector, CAAV's regulatory, planning and policy-making functions should be completely separated from other business functions in the aviation subsector. Accordingly, wherever feasible, operational service functions such as airport ground services should be removed from CAAV. Responsibility for any remaining service functions, such as air traffic management, should be clearly separated within CAAV from regulatory functions so that the oversight functions are not compromised by commercial pressures.

In order to promote efficient airport services it is therefore recommended that further re-organization of CAAV takes place based on the following five principles (already proposed in VITRANSS for sea ports): (a) commercial autonomy for each major airport, (b) continued separation of airport and airline interests (as already embodied in the split between CAAV and VAC), (c) competition both between and within airports wherever possible (but in practice, there are limited opportunities for competition between the airports, so the main emphasis would be on encouraging competition to provide ground and other services within the airport), (d) clear demarcation of responsibilities between government (including MOT and CAAV) and the airports (including separation of regulatory and commercial activities presently within the Airport Authority), and (e) maximum involvement of the private sector (to promote efficiency).

Equitization and privatization of airports, as found in some other countries, is not a feasible way of giving commercial autonomy for the foreseeable future in Vietnam because it would raise too many strategic and security issues, private investors are unlikely to be interested in investing (although a possible exception in the long term could be BOT (Build Operate and Transfer) type projects to build new airport terminals and similar infrastructure), and government is certain to retain control over planning of investment. More realistic options would be (a) to equitise the airports, with national or provincial governments maintaining ownership of the shares (or at least a controlling interest), (b) to award contracts for managing the airports, with government maintaining responsibility for major investments, or (c) to increase cost and performance incentives to the existing State-Owned Enterprise airport authorities under CAAV. Option (a) could achieve complete removal of airport business interests from CAAV. However continued supervision of airports is likely to continue in practice because, apart from the need for safety/environmental oversight activities, there would be a need to monitor airports to control possible monopoly abuse, CAAV would retain a strong interest in coordinating airport planning and because, under current Vietnamese practice, ownership interests are usually vested in sector agencies such as the ministry or a subsector organization such as CAAV. Options (b) and (c) would still require significant business

supervision by CAAV, especially Option (c), and also offer less scope for delegation of commercial autonomy (and of control by local government).

Option (a) is the preferred option because it would allow the possibility of maximum separation of business and regulatory functions within CAAV, and for local government or even other local interests to play an influencing role in airport development. Such an option was recommended in the UNDP Master Plan which also recommended that the airports in each of the country's three regions should have their own financial management system, that no cross-subsidy should be allowed and that each airport component should be self-financing through internally generated revenue, external loans and (if government wished to give support for social or developmental reasons) subsidies.

Implementing such a plan would firstly require splitting the commercial and regulatory activities of the existing Airport Authority and then creating a new airport corporation (or even three separate corporations) with the required distribution of ownership, organization, powers and responsibilities. To reduce disruption and to ensure that safety considerations are not compromised a step by step approach is recommended as follows.

2) CAAV

Although the main function of CAAV will be regulator of air transport, for the next few years this organization would have to maintain a management function, both for airports and for air traffic management services. When developing CAAV organization, these responsibilities should be clearly separated from the regulatory responsibilities, so that the risk of conflict of interest between regulatory and commercial concerns is minimized. Financing regulatory activity should also be completely independent of the remaining business functions so that safety is not compromised in the pursuit of profitability.

There is a need to strengthen the authority of certain parts of CAAV in order to manage the subsector. For example, the current development of the new area control center at HCMC appears to be taking place without regard to the fact that it will be superceded within a few years by a new national center using new technology. This indicates that planning procedures have been weak, with poor central coordination of planning infrastructure investment and inadequate authority by VATM at HQ over project implementation in its regional air navigational service units (either due to a lack of functional authority or to inadequate exercise of VATM authority).

Furthermore, to improve the in-house environmental management capability of CAAV, it is recommended that a position for environmental management officer at CAAV headquarters and in regional airport authorities be created. The responsibilities of this officer assigned in an airport should be to initiate and conduct environmental management and monitoring activities in the airport. The

responsibilities of the officer at CAAV should be to monitor the airports' compliance with environmental regulations and to set suitable environmental standards and regulations in consultation with relevant authorities.

Other institutional improvements recommended in the UNDP/ICAO Master Plan of 1992 but not yet implemented are as follows.

(a) the Civil Aviation Training Center (CATCV) should become part of VATM in order to finance training activities - the logic of this recommendation appears questionable and we consider that there is no reason why the institute cannot be established as an independent organization that earns fees for training personnel from CAAV, VAC and other organisations
(b) the Aviation Science and Technology Institute should become part of the existing Transportation Research and Development Institute or part of an existing university - the case for divesting this institute remains as strong as ever.
(c) Facility life cycle management practices should be introduced, requiring all planning proposals for capital asset acquisition or enhancement should be accompanied and validated by a comprehensive and quantified need, problem, opportunity definition and option analyses. The planning department should monitor proposals in this regard - it is evident from the way that the new area control center in HCMC is being implemented that this proposal as not yet been fully adopted.

The present reporting arrangements for CAAV, direct to the Prime Minister rather than the MOT, is not ideal because (a) policy and regulatory oversight is largely left to CAAV and there is a danger that it becomes judge of its own management activities - a dangerous situation where major safety issues affected by technical considerations are involved, (b) transport policy coordination is made more difficult - under the present arrangement CAAV has to report to several ministries for planning liaison (General Development-Investment Department, Ministry of Construction, MPI, Ministry of Finance and Vietnam National Administration of Tourism). In practice MOT has to be consulted too if overall plans for the transport sector are to be coordinated, but there is no direct reporting between CAAV and MOT to enable this. This arrangement is inconsistent with the government's overall decentralization policies and it is assumed that the present organization is only temporary.

For better coordination with other subsectors, to implement the government's decentralization policies, to reduce the number of reporting lines that CAAV is obliged to observe, and to allow effective oversight of policy implementation (especially safety aspects), it is recommended that responsibility for supervising CAAV is returned from the Prime Minister's Office back to the MOT.

3) Regional Airport Authorities

In order to establish a new airport corporation, the existing airport authority and its

three regional units should be reorganized into two parts to split the business and regulatory functions. The business unit should then be established as one or more corporations, each with a management board and managing director, in accordance with Vietnamese law, with overall responsibility for commercial management of the airports with authority to manage and protect airport assets in accordance with government plans and make contracts with other organisations to provide airport services. The remaining parts of the airport authority would be placed under the appropriate department of CAAV.

Clear financial and performance targets should be set by government in order to give guidance to management, who would otherwise be free to pursue the commercial interests of the corporation.

To enable a degree of competition between airports, for example over use made by airlines of support services and even choice of hub for their operations, consideration should be given to establishing three separate airport corporations with independent management. Even if one single corporation is established, it should be allowed to set user charges for each airport based on their costs so that they are self-financing and cross-subsidies are avoided. If government wishes to reduce charges for certain airports, perhaps for developing access in remote areas, then this should be achieved through direct subsidies at particular airports.

To enable competition within airports and to promote efficiency in the short-term, existing state-owned airport service enterprises should be priority candidates for equitization and allowed to compete freely for contracts at any airport. Such measures could encourage increased private participation in the aviation sector even in the short-term (in accordance with current plans of CAAV).

4) VATM

As described above there is an apparent need to strengthen the lines of authority within VATM so that central management is more effective. This problem of lack of central authority was highlighted in the UNDP Master Plan which recommended urgent action to give the Air Navigational Service Department in HQ clear functional authority over its regional units.

VATM is expected to continue to provide air navigation services within CAAV for the foreseeable future (even after the separation of regulator and operator functions) and so there is a need to give efficiency incentives to VATM management - giving the management increased decision-making powers and rewards for achieving cost/performance targets. The first steps would be to implement regulations that define the organisation, functions, tasks and powers of VATM and to implement fully all the recommendations of the UNDP Master Plan regarding accounting systems and setting of user charges.

As new CNS/ATM facilities and procedures are introduced, VATM’s organizational

structure should be adjusted accordingly.

5) Other Considerations

There is a need to improve planning coordination with government agencies outside the transport sector in the following two ways.

Firstly better coordination is required with the Vietnam Post and Telecommunications Department in order to ensure reliable provision of telecommunication services at airports. Failure to obtain service from the Department would require additional cost in obtaining and operating specialized facilities.

Secondly, as most airports with civil aviation operations in Vietnam are also used by the military, the margin for expansion of civil aviation use is often very limited. A considerable part of the airport area at Danang and Tan Son Nhat is occupied by military facilities.

In general, most airports in the world start their operations as military airports and, as the activities of civil aviation increase, military activities decrease. Separation between civil airports and military airports is a global trend because it allows expansion of civil aviation activities and increases the operational safety of both civil and military aircraft.

If all the military facilities in airports with civil aviation are moved to other military airports, it will increase civil airport capacity and will result in considerable cost savings.

5.5 Regulation

In order to implement higher technical standards as recommended earlier, new aviation regulations have to be implemented. CAAV recognizes the importance of safety and has been implementing the recommendations of the ICAO Conference on a global strategy for safety oversight in Montreal (November 1997), covering inspection/control of flight conditions, supervision/control of flight operation and establishing systems of certification/licensing. CAAV has already promulgated up-to-date regulations on commercial air operation and on aircraft maintenance, and is currently formulating regulations related to pilots, pilot training facilities and aircraft maintenance facilities. The specific task of reviewing and identifying the need for new legislation is currently underway by the French-Vietnam technical assistance project.
Even though the present limited traffic at airports causes only limited environmental impact, the future increase in air traffic will result in serious environmental problems due to airport/aircraft operations. To minimize the impact on the environment and on neighboring residents and to facilitate regular environmental monitoring, the establishment of environmental regulations is proposed.

These regulations should cover such subjects as maximum permissible level of aircraft noise, land-use control plan for surrounding areas of an airport, reduction in aircraft noise, and garbage, oil and sewerage disposal rules.

In addition to establishing higher national technical standards, as described earlier, there is a need to improve the basis of business regulation in order to promote competition. The main issues concern the way that charges are set by government and the conditions under which operators may provide services.

In principle the airline business is not a natural monopoly - although the costs of entry are high, in practice access to finance allows small new entrants to enter the business and compete effectively with larger existing operators. There are no significant economies of scale that prevent the smaller operators from competing with larger one. Under these conditions, provided that administrative entry controls are minimized (apart from those required to set and enforce minimum safety and environmental standards) the airline market in Vietnam (on domestic and international routes) should be competitive, with tariffs being controlled through competitive pressures, and there should be little need for intervention by government to curb monopolies.

Authority to establish airline businesses can only be given by the Prime Minister, on the proposal submitted by CAAV. In practice it seems that authority for airlines is only given to companies that operate within the umbrella of VAC. There are two operators providing scheduled services within Vietnam and these only actively compete on one domestic routes (HCMC to Hanoi) and Pacific Airlines has only a limited share (about 7% of the market). Even on this route there is limited real competition because both enterprises are subject to a high degree of control by VAC. In particular Vietnam Airlines has no separate management from VAC management and 30% of Pacific Airlines is owned by VAC. Fares are the same for the two airlines and the basis for competition is limited to quality of service (Pacific Airlines have personalized video screens for passengers). VAC is empowered to coordinate international services at international airports that, in principle, give it a competitive edge over other airlines. During the recent economic downturn in the subsector, Pacific Airlines had to reduce its fleet from two to one aircraft, severely reducing its presence in the market compared to Vietnam Airlines.

On international services the competition is strictly limited under the bilateral agreements so that again competition is limited to quality of service. However under the forthcoming multilateral transport agreements between ASEAN countries, this situation should change within two years and there will be greater scope for competition on regional routes. This in turn will probably affect the domestic market because of the possibilities for international airlines to operate within Vietnam.

Given the limited competition at present, continued control by CAAV over maximum fare levels may be justified to prevent VAC using its monopoly on many domestic routes to charge excessively high fares. However given the inherently competitive nature of the business and the prospects for increased competition, there is no reason

to continue with these controls in the medium term. In particular it seems unlikely that fares charged on domestic routes would greatly exceed costs because of the limited ability of most passengers to pay the fare.

Rather there is a danger of Vietnam Airlines being pressurized to operate some low density services at fares that are below costs. Some reports have been made that Vietnam Airlines international services cross-subsidize domestic services and our cost calculations confirm that international routes are profitable whereas some short domestic routes are probably not. The main reason for this appears to be the low fares which are charged on short routes that make inadequate allowance for the costs involved. Whereas current domestic fares for Vietnamese passengers on its main longer routes are similar to those charged on similar routes, using similar aircraft, in other countries in the region fares for foreigners are much higher.

Utilization of assets in Vietnam Airlines, such as annual hours flown by aircraft, is similar to that attained in other countries for similar aircraft involved on international, long and short distance domestic routes. Comparison of load factors between countries indicates that Vietnamese airlines operate with quite high ratios on domestic routes (over 80% in some cases which in practice makes it difficult for passengers to purchase tickets on many flights), indicating that the supply of services is inadequate (possibly due to low fares and profits). One way that high load factors could be achieved on minor routes is by canceling flights that have few passengers, but this causes unacceptable passenger inconvenience. These comparisons reveal no evidence of inefficient operations and excessive costs in Vietnam which could account for the low profitability of short distance domestic services, although this could not be confirmed because of lack of available data.

Limiting fares on shorter routes distorts competition between other modes and prevents the airline (Vietnam Airlines) from competing on the same basis as other airlines, in both domestic and international markets. If sustained, this could reduce investment in the Vietnamese airline industry and prevent it from supplying enough domestic capacity. It is therefore recommended that:

(a) fares controls are phased out within the next two years,
(b) in particular the fares differential between Vietnamese and foreigners should be removed because this is not based on a sound marketing rationale and may invite retaliation, especially from other countries in the region
(c) airlines should develop flexible fares policies that suit market conditions and to balance supply and demand more effectively - for example, discriminating between different services provided in different markets or to different types of passengers (for example, higher fares for business passengers traveling at peak times, and lower fares for other passengers traveling at off-peak times who can be carried at marginal cost).

If government wishes to subsidize certain minor services, perhaps to give access to remote areas, then it should subsidize them in a way that encourages efficiency and minimizes costs (for example, by awarding contracts through competitive tendering for

the airline offering the least cost service). This would reduce the cost of subsidy and allow the airlines to compete on an equal basis, not only on domestic routes but also on international routes.

To develop competition further between Vietnamese airlines on domestic routes in the short-term, route licences could be issued, through competitive tendering to the airline that offered the required service at minimum cost (or offered the best quality service for given cost). However this would involve CAAV in additional tasks in planning services, estimating fares and service levels, and administering the tendering procedures, including marketing activities which are normally best left to be carried out by the airlines. Major difficulties would be faced by CAAV when demand fluctuates unexpectedly or if airlines fail to offer the agreed service levels, and additional costs would be incurred by CAAV. The preferred option in the long term would be to allow free entry provided the airlines achieved minimum legal safety standards.

Increased competition among Vietnamese airlines should be encouraged by removing the current ban on foreign direct investment in the airline business (especially in businesses seeking to develop international services to and from Vietnam that would benefit the country, such as through increased tourism). Increased investment would allow modern management methods and technology to be introduced more effectively into the aviation sector and raise operating standards and efficiency in the country (not only on international routes but also on domestic ones).

The government also regulates other fees paid by airlines and passengers for using airline facilities. It is difficult to assess the extent to which charges cover costs of provision because detailed data have not been made available. For the same reason it is difficult to determine how effective the accounting systems are in supplying the necessary cost and revenue information on which to base charges (the UNDP Master Plan made recommendations that this should be substantially improved in order to be able to determine user charges and a means of performance measurement). In overall terms these charges appear to cover costs and even provide a significant surplus (probably mainly attributable to payments by foreign airlines that traverse Vietnamese airspace). However there are differences in profitability between airports because charges at individual airports are not related to local costs. The charges are also similar (in terms of charge structure and level) to charges made by other countries in the region. However discounts are given to Vietnamese airlines which would probably be unacceptable under international rules (especially the rules to be adopted under the forthcoming ASEAN transport agreement). While this encourages use of Vietnamese Airlines on international routes, it deprives the government of revenue for infrastructure. It is strongly recommended that, if not already implemented, the previous UNDP study recommendations on improving the accounting system are implemented, that the discounts for Vietnamese airlines are removed in the short-term and the charges reviewed to cover the operating and capital costs of infrastructure and services provided for both en route services and for terminal services at each location (all three recommendations were made by the previous UNDP study). Wherever possible the charges should be proposed by the agency responsible for service provision and

approved by government - proposed charges should only be refused if there is evidence of monopoly charging which would result in excessive profits (a contravention of ICAO guidelines).

The regulatory recommendations can be summarized as follows:

1) To implement the higher technical standards required to meet future ICAO safety standards
2) New regulations should also be developed in the medium term to provide the legal basis for tackling future environmental problems (especially noise pollution).
3) To allow Vietnamese airlines to adapt services to meet demand on domestic routes and to compete on an equal basis as foreign airlines on international routes, remaining fare controls on domestic routes should be abolished, but fares should be monitored to identify profiteering in monopoly situations.
4) In particular, the differential fare structure between Vietnamese and foreigners should be abolished, leaving Vietnam Airlines free to tailor fares according to its market strategy (which could include discounts for off-peak travel or by people with lower incomes),
5) If government wishes to set lower fares than offered by airlines on particular routes, then these must be compensated with an appropriate direct subsidy for each service.
6) Competition in the domestic sector could be developed in the short term by awarding franchises for each service/route (for example, to the airline offering the lowest cost service for a given service level) and eventually by allowing free competition subject to airlines meeting minimum safety standards,
7) Airport and air traffic charges should be based on costs incurred by en route and terminating services at each airport – these charges should be proposed by the airport corporation and approved by CAAV, unless there is evidence of excessive profit-taking.
8) Government should remove the present ban on foreign direct investment in the aviation subsector to allow a greater range of investment possibilities in the international airline business, promoting more modern management methods and use of modern technology.

5.6 Strategy for Commercialization/Privatization

It is expected that more air carriers will start air transport service in Vietnam by 2020, including private operators. For example, the number of airlines in ASEAN countries has increased dramatically over the last decade and now numbers in excess of 20 operators. Domestic competition now exists in Indonesia (five airlines), Philippines (six airlines) and Malaysia (four airlines). Private operation of airlines rather than state-ownership is now the norm. This has led to lower fares, an increase in market served and more frequencies in existing markets. For example in Indonesia over the last 10 years, the number of services connecting Jakarta, Surabaya, Denpasar, Yogyakarta, and Medan has increased by some 11% per annum. Apart from Garuda Indonesia, which focuses on international service, five airlines now compete on domestic routes.

Thus, if patterns observed in other ASEAN nations are mirrored in Vietnam, deregulation, in concert with economic growth, expansion of air transport infrastructure, revised service agreements between airlines, tourism, and evolution of aircraft technology, will offer great opportunities for new Vietnamese air carriers in future.

In addition to the regulatory changes described above (simplifying the entry requirements to new operators and enhancing safety standards), such changes would require breaking up the VAC monopoly in the aviation industry and transferring the operational units into private hands.

To make such major changes feasible in the long term while promoting efficient transport in the shorter term, it is desirable to adopt a restructuring strategy that promotes fair competition and gives efficiency incentives to existing and future new entrants. The current equitization program of the government offers a good opportunity to implement such a strategy. However equitising the whole of the main airline company is not likely to be high in government priorities because of its strategic nature and the huge capital requirements. The priority should therefore be (a) to ensure that the airlines of VAC (not only Vietnam Airlines but also Pacific Airlines, which is a VAC joint venture, and VASCO) are able to act independently, with management freedom to plan services, utilize resources, subject to strict financial discipline, without any state support such as subsidies or credit guarantees (implying that they should be equitized if necessary by keeping ownership in state hands), and (b) divest from VAC the many smaller support units that offer services to airlines and make them compete with new service providers to provide services to all the airlines and airport enterprises on an equal basis.

To promote real competition in the airline business in Vietnam, VAC's ownership of Pacific Airlines should be reduced by taking a purely passive shareholder role, as a first step in divesting this company from VAC.

Suitable support units that can be divested include

(a) various supply companies such as VINAPCO, AIRIMEX, the Aviation Consultancy, Survey and Design Company, and the Aviation Project Construction Company
(b) the Air Service Companies at each major airport (NASCO, SASCO and MASCO)
(c) any non-business units such as the Civil Aviation Training Center which, as described earlier, can be put on a revenue-earning basis
(d) the five joint ventures in catering, goods handling, freight forwarding and hotel service

CAAV has encouraged private investment in such businesses and this has already led to the establishment within VAC of the joint ventures mentioned above. CAAV has also encouraged greater commercialization of the airports under its administration by allowing peripheral business activities such as selling duty-free goods and advertising. Relatively little commercialization can be expected in air traffic management however. The pace of commercialization/ privatization of air navigation service providers is much slower than for air carriers and airports in the world. This can be attributed to a number

of factors, including air navigation service provision being naturally monopolistic and there is little advantage in their developing non-aeronautical commercial services.

5.7 Human Resource Development

Implementing higher technical and safety standards that meet ICAO requirements will continue to be a major challenge for the aviation subsector.

In the airline industry there will be a need to develop and implement basic training and upgrading training programs for commercial pilots on modern aircraft, flight instructors for Boeing, Airbus, Fokker, ATR, and King Air, flight inspectors, aircraft technicians and cabin staff. In most of these fields the high technical requirements and the need to acquire English make acquisition of skill levels difficult to achieve in Vietnam (the ratio of successfully trained students to applicants is often quite low - only 10% for cabin staff and less than 1% for pilots - suggesting that selection of candidates is critical if training costs are to minimized). In technical and operational fields many existing staff, including instructors, have been trained in Russian and in the use of obsolete technology, and this increases the difficulty of improving training. Overseas training is often required, adding still further to the training difficulties. Much specialized maintenance is currently carried out overseas and the amount of technical training would be significantly enhanced by increasing the amount of maintenance done in Vietnam.

Equally important however is the need to train management in the business skills required for success under the market economy (financial and business planning, management information systems, costing tools, marketing methods, customer relations etc.)

In management of airports and other infrastructure basic training and upgrading training is required in airport operation and management, strategic planning, airport emergencies, airport management staff, air traffic management, maintenance, communication systems, CNS/ATM, aeronautical meteorology, air safety, security, facilitation, rescue and fire fighting. Training in airport design and construction aspects and in airport business methods are also critical for developing effective airport and airline support services.

In subsector administration, there is a need for training in regulatory methods appropriate for a market economy, concerning setting higher technical and operational standards (systems of supervision/control, of certification/licensing etc.), setting fares, assessing competition policies and project evaluation. Training in management systems is required to implement an effective planning and administrative system with adequate lines of authority, management information systems, costing systems for assessing user charges, and contracting mechanisms (especially for large international projects). Training of MOT staff will also be required to enable government to develop and monitor air transport policies and supervise CAAV. CAAV plans to train 100 to 120 persons per year in all professional fields (including airline and

other business fields).

To ensure adequate staff in the aviation subsector, manpower/training plans will need continually updating to cope with changing conditions.

To ensure a continuing supply of trained controllers and maintenance technicians, the facilities at the Civil Aviation Training Center in HCMC should be modernized to include a new ATC procedural trainer, a new ATC radar simulator and a multimedia language laboratory. The center should have a regular annual budget to maintain its training standards. Improvement of facilities would enable it to better serve CAAV and VATM both as a source of controllers and technicians trained in the basic level and as a provider of in-service training for staff in mid-career.

To summarize the human resource development needs, to enable government agencies to fulfill their future responsibilities in the state management of the aviation subsector, priority in training is required for:

1) strengthening MOT with staff qualified to oversee planning and setting of technical standards in aviation,
2) strengthening CAAV to develop air transport plans, set and enforce higher technical and environmental standards through certification/licensing/control systems, and develop the market regulatory system,
3) strengthening the airlines' capability in business management under market conditions and training capacity for pilots, mechanics and other staff,
4) mid-career training and other specific needs to support the 10-year master plan, especially training in planning methods, economic evaluation and methods of managing major international investment projects, and
5) upgrading the Civil Aviation Training Center of Vietnam to meet international qualification standards and to offer training on air transport business management - consideration should be given to financing the center completely through fees paid by VAC and other users.

The bulk of the training required to meet many of the needs outlines above is expected to be required overseas, either because it will take time for the CATCV to develop suitable courses (particularly in respect of CNS/ATM) or because training is not available to an appropriate level in Vietnam. A five-year overseas training plan has therefore been prepared and is proposed in Section 7 of the report.

6 DRAFT MASTER PLAN

6.1 General

The following targets are proposed for the Master Plan for 2010:

- Provide safe and efficient air transport services making it possible to travel between any cities in Vietnam within five hours.
- Increase the capacity of the airports to handle 12 and 10 million passengers per annum, domestic and international respectively.
- Introduce facilities and services for the new CNS/ATM concepts for air navigation and air traffic management.

Priority is given to improving the three primary (international) airports to meet the growing traffic demand, followed by developing the secondary (trunk line) airports, Cat Bi, Phu Bai and Nha Trang. These airports are close to the famous tourist destinations and there is a possibility to receive international tourist charter flights. These secondary airports will be the alternate airports for the three international airports. Third priorities are given to construct new airports at relatively isolated places such as Lao Cai, Cao Bang and Dong Hoi. Air transport will not only provide daily transportation but also access to these areas in emergency situations such as landslides or earthquakes.

6.2 Planning Guidelines

The planning guidelines for the main facilities in this airport classification shown in Table 6.2.1 are based on ICAO standards and recommendations.

Peak hour passenger, peak hour aircraft movements and annual aircraft movements were also calculated based on the JCAB guidelines. Details of the calculations are shown in Appendix F. Passenger traffic in 2015 is used to calculate the facility requirements.

Table 6.2.1
Planning Guidelines by Airport Classification

	Airport Classification		
	Primary	Secondary	Tertiary
Role of the Airport	International	Trunk Line	Regional
Design Aircraft Type	LJ/MJ	SJ	SJ/TP/STP
Seat Capacity	250~	150	150~65
ICAO Code	4E	4D	4C/3C/2B
Runway Category	Precision Instrument	Precision Instrument	Non-precision Instrument
Runway Length (m)	3,600	2,000	2000~1200
Runway Width (m)	45	45	45~30
Runway Shoulder Width (m)	7.5	7.5	7.5/0
Runway Strip Width (m)	300	300	150
Taxiway Width (m)	23	23	23/15
Taxiway Shoulder Width (m)	10.5	7.5	7.5/0
Rescue and Fire Fighting Category	8 ~ 10	6 ~ 8	4 ~ 8
Aeronautical Lighting System	For Night Operation	For Night Operation	For Day Operation

6.3 Airports Development Plan

Primary Airports

1) Noi Bai International Airport

A Master Plan Study was carried out in 1992-1993 and approved by Prime Minister in 1994. Layout plan of the Master Plan is shown in Figure 2.1.1. Details of the Master Plan is described in Section 2.1 of this report. In general, master plans should be reviewed in every 5 years. The Noi Bai Airport Master Plan was prepared in 1993 so that it is recommended to review the master plan from the viewpoint of air traffic demand changes and possibility of future development area.

According to the traffic forecast, total air passenger in Noi Bai Airport will be 7.3 and 9.5 million passengers per annum in 2015 and 2020 respectively. The main capacity constraint of Noi Bai Airport is the passenger terminal building. After the completion of Phase 2 project of “T1”, the total capacity of the building will be 6 to 6.5 million passengers per annum. The air traffic passenger demand will exceed the capacity of “T1” by 2010 so that new passenger terminal building will be required. According to “Feasibility Study on New Development of Passenger Terminal ant the Northern of Noi Bai International Airport by CAAV in August 1994”, CAAV planned to construct a minor image of “T1” at the west side.

JICA prepared the development of the southern area of Noi Bai Airport in 1997. If CAAV considers it necessary to construct a new runway and development the southern area of Noi Bai Airport, measures for land acquisition and land use control should be taken.

There is a plan to convert the existing passenger terminal building into a cargo terminal building. Estimated total fo future cargo traffic volume is 70,000 and 121,000 tons per annum in 2010 and 2020 respectively. It is recommended to consider the future expandability when designing the new cargo terminal building.

The requirements of major airport facilities of Noi Bai International Airport in 2010 are summarized in Table 6.3.1 below.

Table 6.3.1
Facility Requirements of Noi Bai International Airport

	Existing Conditions	Requirements in 2010
Annual Passenger		
International	549,428	2,563,000
Domestic	1,028,706	4,762,520
Annual Cargo		
International [ton]	9,853	65,181
Domestic [ton]	19,736	27,010
Maximum Operating Aircraft	JJ	JJ
Runway		
Length [m]	3,200	3,600
Width [m]	45	45
Taxiway		
Width [m]	30	23
Apron		
International [sq.m]		74,000
Domestic [sq.m]		98,250
Total [sq.m]	200,000	172,250
Passenger Terminal Building*1		
International [sq.m]		48,500
Domestic [sq.m]		43,205
Total [sq.m]	77,000	91,705
Cargo Terminal Building		
Area [sq.m]	1,624	18,438
Rescue and Fire Fighting System		
ICAO Category	9	9
Number of Fire Fighting Vehicles [No.]	3	3

*Note: *1 After the completion of "T1" project*

Runway extension to 3,600m will be required to accommodate the long haul international flights to Europe and North America. The capacity of the "T1" will be 6 to 6.5 million passengers per annum and forecasted annual passengers in

2015 will be 7.3 million. An additional new terminal building will be required to cope with the demand by 2010. Apron expansion and a new cargo terminal building will also be required.

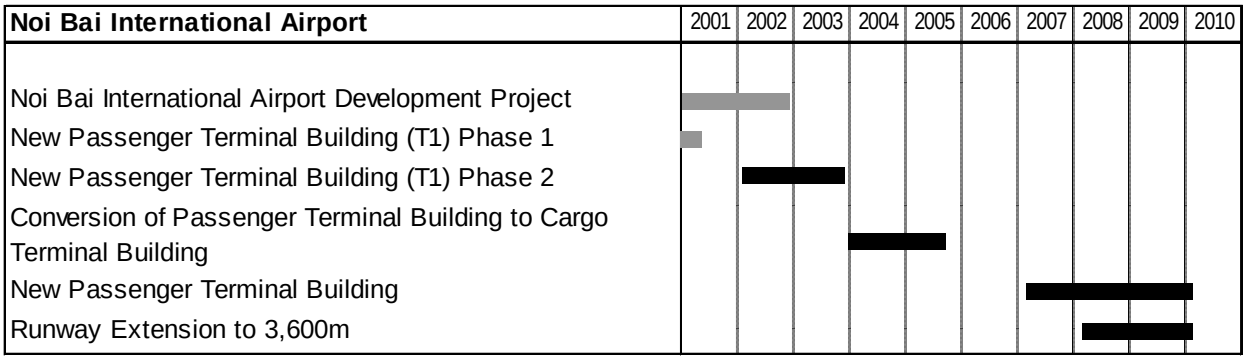
Estimated project cost from 2001 to 2010 is shown in Table 6.3.2 and Project Implementation Schedule is shown in Table 6.3.1.

Table 6.3.2
Cost Estimates of Noi Bai International Airport Development Project

Items	Cost [million US$]
Runway	4.9
Passenger Terminal Building*	207.3
Cargo Terminal Building	10.0
Others	10.4
Total	232.6

Note: Phase 2 of "T1" is included.

Figure 6.3.1
Project Implementation Schedule



2) Danang International Airport

It is expected that many domestic and international routes between Da Nang and tertiary airports and between Da Nang and sub-regional cities will be opened. Estimated total of domestic and international air traffic passengers in Da Nang are 1.7 and 3.3 million passengers per annum in 2010 and 2020 respectively.

The passenger terminal was originally constructed in 1978 and many expansions were carried out to cope with the demand. Because of the limited available area for expansion, further development of this building to cope with the above future air traffic demand is difficult. New passenger terminal building and cargo terminal building will be required.

The requirements of major airport facilities of Danang International Airport in 2010 are summarized in Table 6.3.3 below.

Table 6.3.3
Facility Requirements of Danang International Airport

	Existing Conditions	Requirements in 2010
Annual Passenger		
International	0	718,000
Domestic	407,324	1,620,235
Annual Cargo		
International [ton]	0	18,260
Domestic [ton]	2,733	5,110
Maximum Operating Aircraft	MJ	MJ
Runway		
Length [m]	3,048	2,500
Width [m]	45	45
Taxiway		
Width [m]	25	23
Apron		
International [sq.m]		62,300
Domestic [sq.m]		40,750
Total [sq.m]	117,298	103,050
Passenger Terminal Building		
International [sq.m]		26,531
Domestic [sq.m]		15,661
Total [sq.m]	6,702	42,192
Cargo Terminal Building		
Area [sq.m]	600	4,674
Rescue and Fire Fighting System		
ICAO Category	7	8
Number of Fire Fighting Vehicles [No.]	3	3

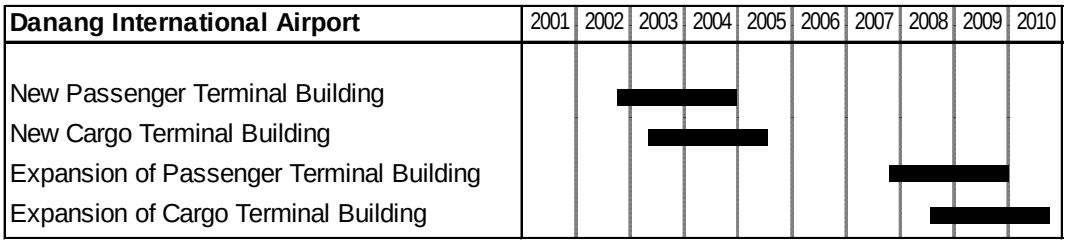
The existing passenger terminal building will not be able to handle the future traffic demand. A new passenger terminal building will be required. Existing cargo handling facilities are very small so that a new cargo terminal will be required.

Estimated project cost from 2001 to 2010 is shown in Table 6.3.4 and Project Implementation Schedule is shown in Figure 6.3.2.

Table 6.3.4
Cost Estimates of Danang International Airport Development Project

Items	Cost [million US$]
Passenger Terminal Building	50.9
Cargo Terminal Building	2.4
Others	12.2
Total	65.5

Figure 6.3.2
Project Implementation Schedule



3) Tan Son Nhat International Airport

Total air passenger traffic in Tan Son Nhat Airport will reach 9.1 and 15.4 million passengers per annum in 2010 and 2020 respectively.

There are two runways in close parallel configuration and a complete parallel taxiway so that there are no constraints of capacity in runways and taxiways.

After the completion of expansion of the international passenger terminal building by 2002, total capacity of the international and domestic building will be 5 million passengers per annum. There is a plan to construct a new international passenger terminal building with a floor area of 100,000 sp.m and a capacity of 8 million passengers per annum by 2005.

There is a plan to construct a new international airport in Long Thanh, where there is an unused old military airport. Government requested CAAV to prepare a master plan for the new airport. Long Thanh Airport is located 35 km east from Tan Son Nhat Airport. There is a plan to construct a new road from Ho Chi Minh City to Vung Tau and Long Thanh Airport is located to this road.

Available land for civil aviation development in Tan Son Nhat is limited and because the urbanization in HCMC is progressing rapidly, aircraft noise will be an environmental problem in the near future. From the viewpoint of urban development in HCMC, there are many opportunities to develop the Tan Son Nhat Airport area for other purposes.

CAAV estimated project cost of a new international passenger terminal building as US$ 200 million and ODA is considered the financial sources. If a new airport will be opened in 2020, this new passenger terminal building will be used for only 15 years and such a short period may not be enough to return the loan.

It is recommended to carry out a detail study including the possibility of development of the existing airport and a new airport development should consider the life cycle cost and urban development in Ho Chi Minh City.
The requirements of major airport facilities of Tan Son Nhat International

Airport in 2010 are summarized in Table 6.3.5

Table 6.3.5
Facility Requirements of Tan Son Nhat International Airport

	Existing Conditions	Requirements in 2010
Annual Passenger		
International	1,792,006	6,973,000
Domestic	1,308,791	5,110,223
Annual Cargo		
International [ton]	49,693	177,333
Domestic [ton]	21,432	62,831
Maximum Operating Aircraft	JJ	JJ
Runway (Primary Runway 07L/25R)		
Length [m]	3,045	3,500
Width [m]	45	45
Taxiway		
Width [m]	23	23
Apron		
International [sq.m]		127,850
Domestic [sq.m]		106,150
Total [sq.m]	162,500	234,000
Passenger Terminal Building		
International [sq.m]	24,000	73,507
Domestic [sq.m]	7,000	45,992
Total [sq.m]	31,000	119,499
Cargo Terminal Building		
Area [sq.m]	22,000	48,033
Rescue and Fire Fighting System		
ICAO Category	9	9
Number of Fire Fighting Vehicles [No.]	3	3

Southern Airports Authority is carring out pavement strengthening of the secondary runway (07R/25L), taxiways and aprons and these works will be completed by 2002. As compared with the current facility sizes and future requirements in 2010, primary runway extension, apron and passenger terminal buildings will need to be expanded.

There is a plan to construct a new Ho Chi Minh Airport in Long Thanh by 2020

It is urgent requirement to expand the capacity of Tan Son Nhat International Airport to meet the current and future demand. However, to utilize the limited investment budget effectively, it is recommended to establish the future development and transfer plan of Tan Son Nhat Airport and Long Thanh Airport by considering the life cycle cost management.

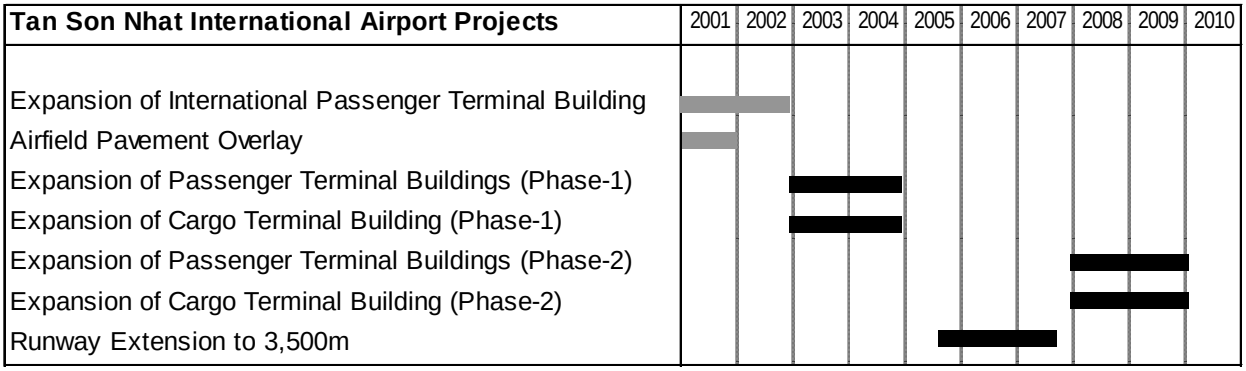
In this Study, further expansion of the passenger terminal building is considered for the following cost estimate.

Estimated project cost from 2001 to 2010 is shown in Table 6.3.6 and Project Implementation Schedule is shown in Figure 6.3.3.

Table 6.3.6
Cost Estimates of Tan Son Nhat International Airport Development Project

Items	Cost [million US$]
Runway	4.1
Apron	25.0
Passenger Terminal Building	119.8
Cargo Terminal Building	15.6
Others	32.9
Total	197.4

Figure 6.3.3
Project Implementation Schedule



Regional Airports Development

Among the other regional airports, air passenger traffic demand exceeds 200,000 passengers per annum in Cat Bi, Phu Bai and Nha Trang Airports in 2020. All the three airports are located close to the famous tourist destinations, i.e., Halong Bay, Hue and Nhat Trang. As liberalization of the air transport sub sector will be progress among Indochina countries and ASEAN countries, it is expected that there will be more chartered international flights to/from these three airports.

The passenger terminal buildings in these three airports are old and small. Construction of a new passenger terminal building will be required to cope with the demand and to improve the impression of Vietnam to the international tourists. On planning the passenger terminal building in these airports, future expandability and future area for the handling of international passengers should be considered.

Most of the regional airports were constructed 20 to 30 years ago and not many improvement projects have been carried out in these airports. As the economic conditions of the regional area improve, more passengers will use the regional airports. Expansion or construction of new passenger terminal buildings and airfield pavement overlay will be required in most of the regional airports.

A Master Plan Study and prioritization of the development project will be necessary.

Secondary Airports

The requirements of major airport facilities of Secondary Airports, Cat Bi, Phu Bai and Nha Trang in 2010 are summarized in Table 6.3.7 below.

Table 6.3.7
Facility Requirements of Secondary Airports

Airports	Cat Bi Airport		Phu Bai Airport		Nha Trang Airport	
	Existing Conditions	Requirements in 2010	Existing Conditions	Requirements in 2010	Existing Conditions	Requirements in 2010
Annual Passenger						
Domestic	50,814	280,320	147,355	319,375	143,459	250,755
Annual Cargo						
Domestic [ton]	1,385	4,380	2	0	1	365
Maximum Operating Aircraft	SJ	SJ	SJ	SJ	SJ	SJ
Runway						
Length [m]	2,400	2,000	2,700	2,000	1,860	2,000
Width [m]	50	45	40	45	45	45
Taixway						
Width [m]	18	18	18	18	15	18
Apron						
Total [sq.m]	15,129	20,700	42,000	20,700	15,000	20,700
Passenger Terminal Building						
Total [sq.m]	1,942	5,779	2,000	6,020	1,500	5,596
Cargo Terminal Building						
Area [sq.m]	0	876	0	0	0	0
Rescue and Fire Fighting System						
ICAO Category	5	6	5	6	0	6
Number of Fire Fighting Vehicles [No.]	1	2	2	2	0	2

Expansion of passenger terminal buildings will be required in all the secondary airports. It is possible that occasional international flights will use them for emergency, tourism or business charter flights, etc, so that when planning the passenger terminal buildings, it is necessary to consider the future space for customs, immigrations and quarantine facilities.

For operational safety of the aircraft, security fences should be provided to restrict the access to the airfield.

Runway lengths at Cat Bi and Phu Bai airports will be sufficient for domestic flights and emergency landing of large aircraft and jumbo jets.

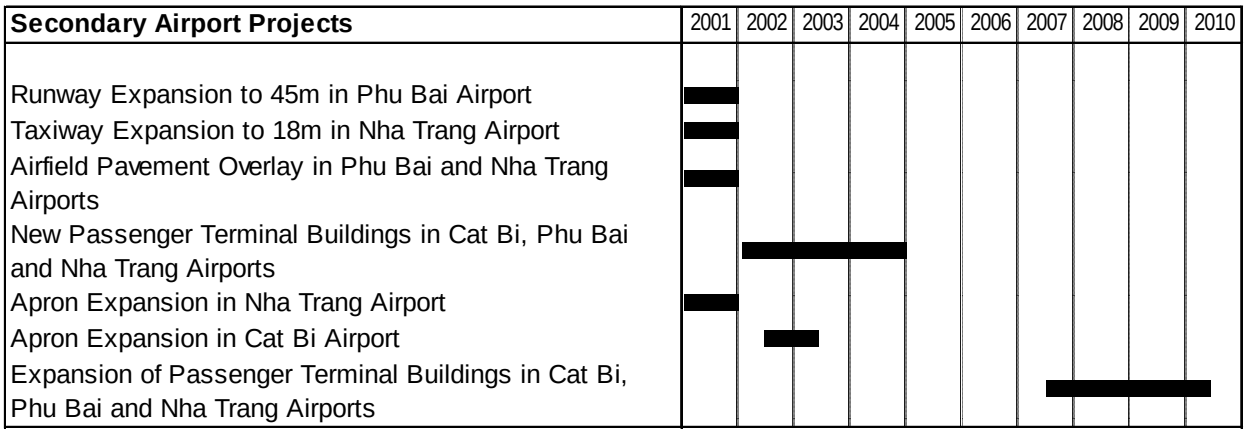
Runway extension will be required at Nha Trang Airport. A detailed study will be required to calculate the necessary extension taking account of elevation, runway slope, wind speed and directions, temperatures, etc. The visibility of the control tower should be evaluated on extending the runway and if necessary, a new control tower should be constructed. Taxiway expansion will be required in Nha Trang to meet ICAO recommendations. From a visual observation of Phu Bai and Nha Trang airports, pavement overlay will be required to accommodate more frequent flights.

Cost estimate of the secondary airports project are shown in Table 6.3.8 and Project Implementation Schedule is shown in Figure 6.3.4.

Table 6.3.8
Cost Estimate of Secondary Airports Projects

Airport Name	Cost [million US$]
Cat Bi	25.0
Phu Bai	26.1
Nha Trang	31.9

Figure 6.3.4
Project Implementation Schedule



Tertiary Airports

1) New Airports

Four new airports are included in the master plan up to 2010. These are Cao Bang, Lao Cai, Dong Hoi and Chu Lai. One of these, Lao Cai is a new airport while the others are old unused airports that will be renovated. The facility

requirements of major airport facilities of those new airports in 2010 are summarized in Table 6.3.9. All the new airports will be designed for the use of turboprop size aircraft.

Table 6.3.9
Facility Requirements of New Airports

	Cao Bang Airport	Lao Cai Airport	Dong Hoi Airport	Chu Lai Airport
Annual Passenger				
Domestic	20,075	22,265	22,265	88,330
Maximum Operating Aircraft	TP	TP	TP	TP
Runway				
Length [m]	1,500	1,500	1,500	1,500
Width [m]	30	30	30	30
Taixway				
Width [m]	18	18	18	18
Apron				
Total [sq.m]	7,700	7,700	7,700	10,500
Passenger Terminal Building				
Total [sq.m]	1,155	1,168	1,168	2,212
Rescue and Fire Fighting System				
ICAO Category	5	5	5	5
Number of Fire Fighting Vehicles [No.]	1	1	1	1

Cao Bang is a mountainous province in the north. The road network in this area is not well developed. A new airport will contribute to regional development and will provide emergency access to this province. According to the CAAV, there is an old unused airport in Cao Bang. The possibility of utilizing this airport for civil aviation use should be evaluated.

Lao Cai is a mountainous province in the northwest. Lao Cai is a border town between Vietnam and China. Since there is a famous mountain resort, Sapa, close to Lao Cai and there are ethnic minority groups living in this area, there is a potential for tourism development here. Estimated flight time between Hanoi and Lao Cai is approximately 50 minutes with turboprop type aircraft. Since there is no airport or airfield in this area, site selection should be carried out first.

Dong Hoi is located between Vinh and Phu Bai airports. This area is considered as a “blank” area in the air transport network. There is an old unused airport in Dong Hoi which can possibly be converted to civil aviation use.

Chu Lai is located 90 km south of Danang Airport. There is an old military airport in Chu Lai. There is a joint venture oil refinery and development project for a deep sea port close to Chu Lai Airport. Government of Vietnam plans to develop this area as a free trade zone. According to the 1997 JICA study, this airport can be utilized using a relatively small investment.

Cost estimate of the new airport projects are shown in Table 6.3.10.

Table 6.3.10
Cost Estimate of New Airports Projects

Airport Name	Cost [million US$]
Cao Bang	25.2
Lao Cai	21.4
Dong Hoi	16.6
Chu Lai	23.8

2) Other Regional Airports

Facility requirements of major airport facilities in other Tertiary Airports are shown in Table 6.3.11.

Table 6.3.11
Facility Requirements of Major Airport Facilities in Tertiary Airports

	Nasan	Dienbien	Vinh	Phucat	Tuy Hoa	Pleiku
Annual Passenger (Domestic)	22,630	36,865	69,350	47,888	11,972	89,790
Maximum Operating Aircraft	TP	TP	TP	TP	STP	SJ
Runway Length [m]	1,500	1,500	1,500	1,500	1,000	2,000
Runway Width [m]	30	30	30	30	30	45
Taixway Width [m]	18	18	18	18	11	18
Apron Area Total [sq.m]	7,700	7,700	7,700	10,500	2,800	17,900
Passenger Terminal Building Floor Area [sq.m]	1,171	1,259	1,460	1,961	708	3,965
Rescue and Fire Fighting System						
ICAO Category	5	5	5	5	3	6
Number of Fire Fighting Vehicles [No.]	1	1	1	1	1	2

	Buon Ma Thuot	Lienkhuong	Rachgia	Phu Quoc	Ca Mau
Annual Passenger (Domestic)	116,070	61,320	14,093	42,705	37,230
Maximum Operating Aircraft	SJ	TP	STP	TP	TP
Runway Length [m]	2,000	1,500	1,000	1,500	1,500
Runway Width [m]	45	30	30	30	30
Taixway Width [m]	18	18	11	18	18
Apron Area Total [sq.m]	17,900	10,500	2,800	7,700	7,700
Passenger Terminal Building Floor Area [sq.m]	4,128	2,045	721	1,295	1,261
Rescue and Fire Fighting System					
ICAO Category	6	5	3	5	5
Number of Fire Fighting Vehicles [No.]	2	1	1	1	1

Currently small aircraft, ATR72 and F70, are operated in the tertiary airports. Larger aircraft, A320 or B737, will be operated in Pleiku and Buon Ma Thuot so that runway extension and pavement overlay will be required in these two airports. Expansion of the apron will be required in Nasan, Dienbien, Vinh, Pleiku, Buon Ma Thuot and Phu Quoc. As the existing passenger terminal buildings are small,

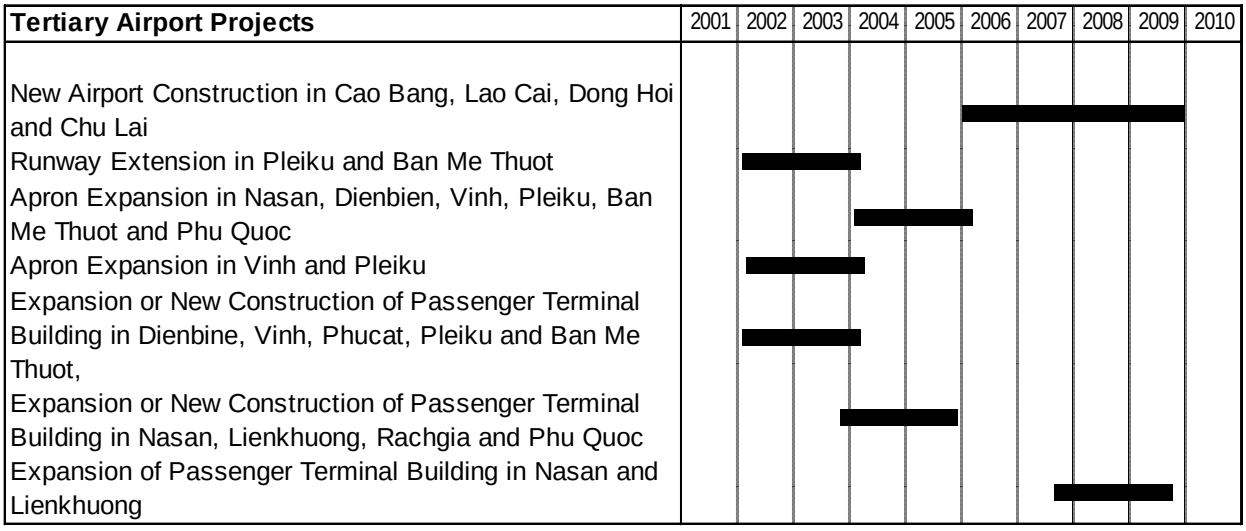
approximately 500 to 1,000 sq.m, expansion or new construction of the passenger terminal buildings will be required in most of the airports.

Project costs of each airport development project is shown in Table 6.3.12 and Project Implementation Schedule is shown in Figure 6.3.5.

Table 6.3.12
Cost Estimate of Tertiary Airports Projects

Airport Name	Cost [million US$]
Nasan	7.2
Dienbien	3.2
Vinh	5.6
Phucat	4.0
Tuy Hoa	10.7
Pleiku	23.7
Buon Ma Thuot	41.1
Lienkhuong	3.8
Rachgia	2.4
Phu Quoc	3.1
Ca Mau	13.4

Figure 6.3.5
Project Implementation Schedule



6.4 Air Navigation Systems

Air Traffic Management

The introduction of CNS/ATM systems and management techniques will facilitate the consolidation of the ACCs at Ho Chi Minh and Hanoi into a single ATM center controlling air traffic in, at least, all the airspace of Vietnam. This new center will also provide approach control for the three international airports of Noi Bai, Tan Son Nhat and Danang, using radar information provided from composite data from all radars in Vietnam.

Factors complicating developments are:

- Ho Chi Minh ACC: Reconstruction of this ACC will have begun even before this study is presented to government. As far as is known, the remodeled ACC will follow the current conventional pattern, that is, the facilities will be based on those employed in the ACC it replaces.

- Hanoi ACC: The VATM plans to remodel the Hanoi ACC in the near future, although it is not yet known whether it will be CNS/ATM-compatible from the design stage or if it will be based initially on conventional facilities.

Resolution of these complications may be achieved in one of two ways, namely:

- Alternative A: Proceed with the proposed reconstruction of Ho Chi Minh ACC but install equipment suitable for CNS/ATM for the control of all of Vietnam's airspace. The airspace could be renamed Hanoi FIR since, with the new ATM procedures, it is immaterial where the ATM center is located. This may delay completion of the HCM ACC project by about one year but would be the most economical solution.

- Alternative B: Proceed with the proposed reconstruction of Ho Chi Minh ACC using conventional systems as planned but delay remodeling of Hanoi ACC until 2005 because a new center at that time will:

  - allow more time for dialogue with neighboring states and the ICAO regarding collaboration on the development of ATM centers in the region;
  - avoid the need to develop a new center in Hanoi using obsolete systems and techniques;
  - facilitate the unification of ATM for Vietnam airspace under the control of a new center in Hanoi; and
  - facilitate the introduction of CNS/ATM developments which are expected to be more definitive by 2005.

A further complication to the foregoing is the need for the CAAV to continue with

its development plans for the expansion of air transport in Vietnam. This will demand the continuing, limited installation of conventional systems where new CNS equipment and procedures are not yet available. This appears unavoidable, so the two alternative master plans initially considered for the air navigation system included a minimal amount of conventional ground-based facilities for cater to the immediate expansion needs of the air transport system. These conventional systems will remain operational until the full transition to CNS/ATM in 2010 or, if necessary, until the end of their life expectancy.

The two alternative master plans outlined in the previous paragraph were first considered, since rehabilitating the HCM ACC is already in progress. Constructing it as an ATM center for the national airspace and not proceeding with rebuilding the Hanoi ACC would represent a savings of about US $20 million. While the alternatives were being studied, however, the Team was informed that the CAAV policy was to transfer future management of the national airspace to a center in Hanoi.

The Master Plan for the Air Navigation System outlined below is therefore based on Alternative B, that is:

- the proposed reconstruction of HCM ACC proceeds as planned using conventional systems but remodeling the Hanoi ACC is delayed until 2005, when it can incorporate the latest facilities available for CNS/ATM.
- a limited expansion of conventional facilities proceeds to meet high-priority airport needs foreseen by the CAAV.

CNS/ATM Requirements

States must implement the following CNS/ATM procedures/facilities by 2010:

(1) Air Traffic Management:

Optimized sectorization
RNAV ATS routes
Flexible use of airspace
Application of required navigation performance (RNP)
Flight profile conformance monitoring
Conflict prediction and resolution advice
Reduced separation in vertical, longitudinal and lateral planes
Data link communications
Minimum safe altitude warning
Application of both conventional and GNSS procedures in all airports
Acceptance of user-preferred flight profiles
Centralization of air traffic flow management (ATFM)
Establishment of an ATFM database

(2) Communications:

VHF voice: analog
VHF data link (VDL): digital
HF voice: analog
HF Data Link: digital
AMSS
ATN

(3) Navigation:

ILS (will phase out in 2010)
VOR/DME (will phase out in 2010)
GNSS
SBAS
GBAS

(4) Surveillance:

ADS
ADS-B
SSR Mode S

The proposed master plan caters for the above criteria, together with the equipment needed to meet CAAV's development plans.

Master Plan for the Air Navigation System

(1) Facilities

2002 - Complete reconstruction of Ho Chi Minh ACC
2005 - Construct a new ATM center in Hanoi
2007 - Install Tower Control Package and AWOS equipment in 4 new Tertiary Airport

(2) Air Traffic Management

2001 - Plan for the consolidation of Vietnam airspace as the Hanoi FIR under the control of a single ATM center in Hanoi
- Plan for the introduction of:
Optimized sectorization
RNAV ATS routes
Flexible use of airspace
Application of RNP
Flight profile conformance monitoring

Conflict prediction and resolution advice
Reduced separation in vertical, longitudinal and lateral planes
Data link communications
Minimum safe altitude warning
Application of conventional and GNSS procedures in airports
Acceptance of user-preferred flight profiles
Centralization of ATFM
Establishment of an ATFM database

2003 - As an interim measure, install new Flight Plan Data Processing equipment at the new Ho Chi Minh ACC
2005 - Introduce improved SAR facilities
2006 - Install new Flight Plan Data Processing equipment suitable for CNS/ATM procedures at the new Hanoi ATM center
- Consolidate the airspace of Vietnam under the control of the Hanoi ATM center
- Implement plans for:
  Optimized sectorization
  Fixed RNAV ATS routes
  Flexible use of airspace
  Application of RNP
  Flight profile conformance monitoring
  Conflict prediction and resolution advice
  Reduced separation in vertical, longitudinal and lateral planes
  Data link communications
  Minimum safe altitude warning
  Application of conventional and GNSS procedures in airports

2006 - Transfer Tan Son Nhat and Danang approach control to Hanoi ATM center
- Introduce automated AIS system

2007 - Close HCM ACC and the Approach Controls at Tan Son Nhat and Danang
- Accept user-preferred flight profiles
- Centralize ATFM
- Establish an ATFM database

2010 - All CNS/ATM procedures in place at Hanoi ATM center

(3) Communications

2001 - Upgrade communications facilities to cater to ATN
2003 - Install multimode VHF transmitters and receivers in all remote VHF stations for controller-pilot communications (both voice and digital data), in international airports and domestic airports, where necessary.
2004 - Restructure ATS-DS circuits to cater to the transfer of control to Hanoi ATM center

- Provide HF Data Link facilities

2005
- Provide ATIS equipment in all major airports
- Restructure AFTN circuits to cater to the transfer of control of all Vietnam airspace to Hanoi

2006
- Install and replace voice logging recorders at the Hanoi ATM center, international and domestic airports

2008
- Provide equipment for ADS Broadcast

2009
- Introduce progressive plan for improvement of Class 3 airports

(4) Navigation

2001
- As an interim measure, replace 6 NDBs which are more than 15 years old
- Install ILS and VOR/DME at Nha Trang Airport
- Replace old DME at Phan Thiet

2002
- As an interim measure, install 7 NDBs, one each at the proposed new airports

2002
- Install ILS and VOR/DMEs at 2 other high priority airports designated as Class 1

2007
- Progressively introduce ground area augmentation systems at Hanoi/Noi Bai, Ho Chi Minh City/Tan Son Nhat and Danang and five other airports where instrument approaches are required.

(5) Surveillance

2002
- Replace obsolete Ckala-M radar at Noi Bai with a new PSR/MSSR with Mode S capability

2002
- Upgrade (or replace if necessary) existing SSRs at Tan Son Nhat, Qui Nhon and Sontra for Mode S capability

2003
- Install new MSSR-Mode S at Camau and Vinh

2005
- Introduce ADS

(6) Support Services

2001
- Establish a laboratory for the calibration of test equipment

2001 Onward
- Introduce progressive program for replacement of old equipment

2000 Onwards
- Continue contract for flight inspection of navigation aids

2001 Onwards
- Training: Introduce progressive program to upgrade CATC, Ho Chi Minh City, including replacement of procedural trainer, new multimedia language laboratory, new ATC radar simulator and other necessary training equipment
- Introduce a progressive training program for CAAV, VATM and

MOT Staff

2002 - Procure replacement test equipment for all instruments over 10 years old
- Establish budget for spare parts to be procured over next 5 years

2007 - Introduce new MET equipment at the Aeronautical MET Center

Cost Estimates

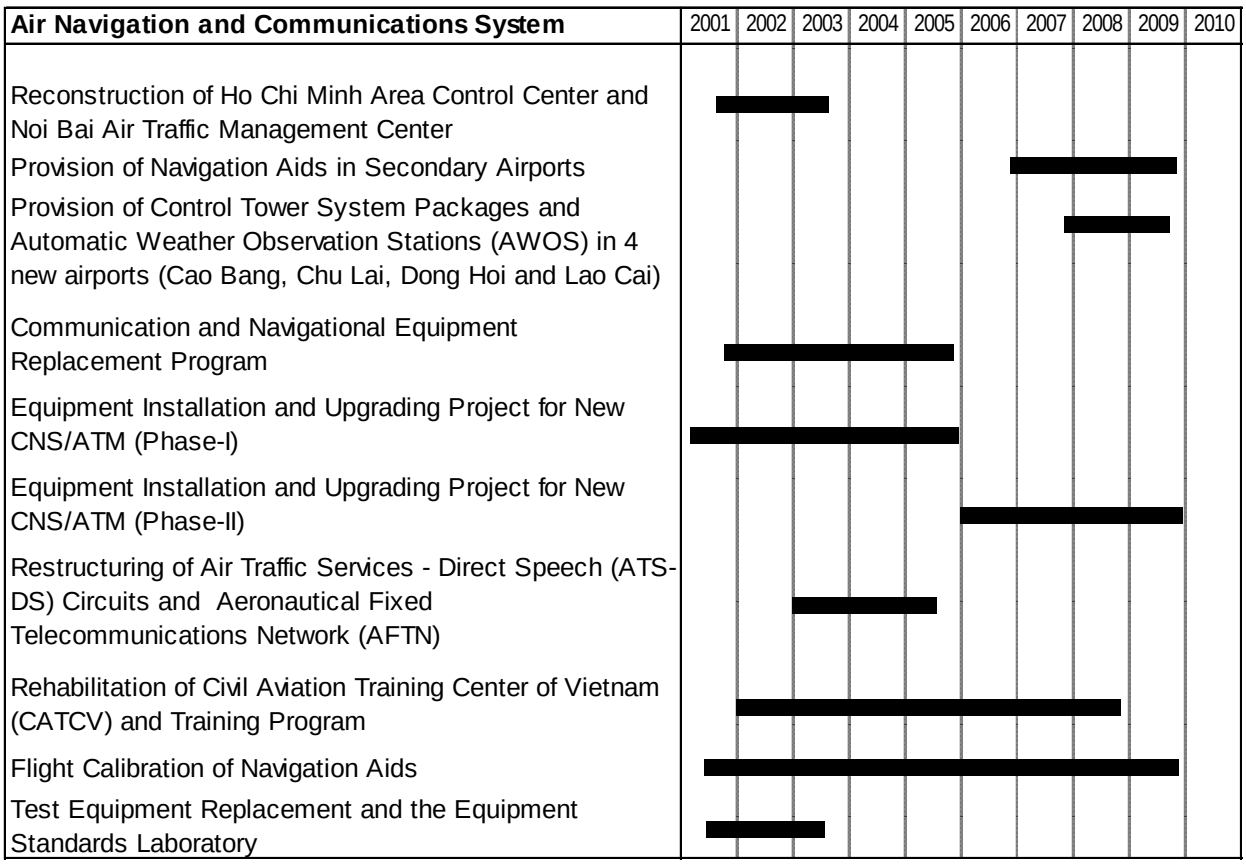
Cost estimates of air navigation and communications projects are shown in Table 6.4.1

Table 6.4.1
Cost Estimate of Air Navigations and Communications Projects

Projects Name	Schedule	Cost [million US$]
Reconstruction of Ho Chi Minh Area Control Center and Noi Bai Air Traffic Management Center	2001-2007	58.0
Provision of Navigation Aids in Secondary Airports	2001-2004	4.5
Provision of Control Tower System Packages and Automatic Weather Observation Stations (AWOS) in 4 new airports (Cao Bang, Chu Lai, Dong Hoi and Lao Cai)	2001-2010	1.3
Communication and Navigational Equipment Replacement Program	2001-2010	12.2
Equipment Installation and Upgrading Project for New CNS/ATM (Phase-I)	2001-2005	32.8
Equipment Installation and Upgrading Project for New CNS/ATM (Phase-II)	2006-2010	10.9
Restructuring of Air Traffic Services - Direct Speech (ATS-DS) Circuits and Aeronautical Fixed Telecommunications Network (AFTN)	2003-2005	2.5
Rehabilitation of Civil Aviation Training Center of Vietnam (CATCV) and Training Program	2001-2007	3.7
Flight Calibration of Navigation Aids	2001-2010	1.1
Test Equipment Replacement and the Equipment Standards Laboratory	2001-2002	1.9

Implementation Schedule is shown in Figure 6.4.1

Figure 6.4.1
Implementation Plan



6.5 Future Fleet Plan

Future aircraft fleet plan is estimated as shown in the Table 6.5.1. This is the total of aircraft fleet in Vietnam.

Table 6.5.1
Future Aircraft Fleet

	JJ B747/A340	LJ B767-300	MJ B767-200	SJ A320	TP ATR72/F70	Total
Required Fleet in 2010						
International	4	3	2	4	2	15
Domestic	0	7	3	3	4	17
Total	4	10	5	7	6	32
Existing Fleet	0	3	0	12	7	22
Required Fleet	4	7	5	0	0	10
Price [MillionUS$]	178	111	95	35	11	
Cost [MillionUS$]	712	777	475	0	0	1964

Detailed calculations are shown in Appendix F.

APPENDICES

APPENDIX A
LIST OF PROJECTS IN AIR TRANSPORT

Project Name	Location	Initiator of Project	Implementation Agency	Outline of Project	Estimated Cost	Estimated Year	Financial Source	Schedule
Runway extension and overlay in Ca Mau Airport	Ca Mau Airport	Southern Airports Authority	Southern Airports Authority	Runway Extension and Overlay (Area 55,000sq.m)	1million USD	1999	Southern Airports Authority	October 1999 to Feb 2000
Cao Bang New Airport	Cao Bang	Northern Airport Authority		Construction of New Airport in Cao Bang	110billion VND	1999	Not decided	Under investment preparation
Cat Bi Airport Project	Cat Bi Airport, Haiphong	Northern Airports Authority		Improvement Plan	Not Available	Not Available	Not Available	Not Available
ILS installation Plan	Cat Bi Airport, Haiphong	CAAV	CAAV	Install new ILS	Not Available	Not Available	Not Available	Not Available
Chu Lai Airport Development Plan	Chu Lai Airport, Quang Nam-Da Nang Province	Quang Nai Provincial People's Committee		Master Plan of Chu Lai Airport up to 2010	Not Available	Not Available	Not Available	Not Available
Chu Lai Airport Development Plan	Chu Lai Airport, Quang Nam-Da Nang Province	JICA		Long Term Development Plan of Chu Lai Airport	20 million USD	1997	Not Available	1996 to 2010
Civil Aviation Training Centre of Vietnam Improvement Plan	Civil Aviation Training Centre of Vietnam, Ho Chi Minh City	CATCV		Upgrade the facilities and training courses in CATCV	Not Available	Not Available	Not Available	by 1999 becomes College by 2003 becomes University

APPENDIX A
LIST OF PROJECTS IN AIR TRANSPORT

Da Nang International Airport Improvement	Danang Airport	JICA		Long Term Development Plan of Danang Airport	90 million USD	1997	Not Available	
Terminal Building Renovation in Da Nang International Airport	Danang Airport	CAAV	CAAV	To separate the passenger flow between international arrival and domestic arrival	Not Available	Not Available	Not Available	Will be completed by Oct 99
Dien Bien Airport Project	Dien Bien Phu	Northern Airports Authority		Improvement Plan	Not Available	Not Available	Not Available	Not Available
Gia Lam Airport Project	Gia Lam, Hanoi	Northern Airports Authority		Improvement Plan	Not Available	Not Available	Not Available	Not Available
Installation of Fire Fighting Facilities in Nhatrang Airport	Nhatrang Airport	CAAV	CAAV	Construction of new Fire Station and installation new Fire Fighting Vehicles	Not Available	Not Available	Not Available	Fire station will be completed by Oct '99 Installation of FFV by Oct '99
Noi Bai Airport Expansion and Improvement Project	Noi Bai Airport Soc Son District	Northern Airport Authority	Northern Airport Authority	Expanding the north of Noi Bai Airport	800billion VND	1999	State Budget	1996 to 2002
Passenger Terminal (T1) Construction Project in Noi Bai Airport	Noi Bai Airport Soc Son District	Northern Airports Authority	Northern Airport Authority	Construction of new Passenger Terminal Building	538billion VND and 34 million USD	1999	State Budget and credit loan	1995 to 2000
Noi Bai Airport Development Project	Noi Bai Airport Soc Son District	JICA	Northern Airport Authority	Construction of new southern airport at Noi Bai Airport	453million USD	1995	Domestic 121.5million USD (not yet confirmed), 453million (ODA)	1997 to 2007
ILS installation Plan	Noi Bai Airport Soc Son District	CAAV	CAAV	Install new ILS GP in civil aviation area	Not Available	Not Available	Not Available	Not Available

APPENDIX A
LIST OF PROJECTS IN AIR TRANSPORT

Phu Bai Airport Master Plan	Phu Bai Airport, Hue	Middle Airports Authority	CAAV	Master Plan of Phu Bai Airport up to year 2010	Not Available	Not Available	Not Available	Not Available
Phu Bai Airport Development Plan	Phu Bai Airport, Hue	JICA		Development Plan of Phu Bai Airport up to year 2010	40 million USD	1997	Not Available	1997 to 2010
Phu Bai Airport Development Plan	Phu Bai Airport, Hue	CAAV	CAAV	Overlay on Taxiways in Phu Bai Airport	22 million USD	1999	Not Available	by Apr 99: DD will be completed.
ILS installation Plan in Phu Bai Airport	Phu Bai Airport, Hue	CAAV	CAAV	Install new ILS	Not Available	Not Available	Not Available	Not Available
VOR/DME Installation Plan in Phu Bai Airport	Phu Bai Airport, Hue	CAAV	CAAV	Install new VOR/DME	Not Available	Not Available	Not Available	Not Available
Dong Hai New Airport	Quang Binh	Northern Airport Authority		Construction of New Airport in Quang Binh	34billion VND	1999	Not decided	Under investment preparation
New International Terminal Building in Tan Son Nhat Airport	Tan Son Nhat Airport	Southern Airports Authority		New International Passenger Building Construction	240million USD	1999	OECF (not confirmed)	Not Available
Passenger Terminal Expansion Project In Tan Son Nhat Airport	Tan Son Nhat Airport	Southern Airports Authority	Southern Airports Authority	Expansion of International Passenger Building	12million USD	1997	Southern Airports Authority	June 1997 to 2000
Runway overlay in Tan Son Nhat Airport	Tan Son Nhat Airport	Southern Airports Authority	Southern Airports Authority	Runway Overlay (Area: 138,000sq.m)	15million USD	1999	Southern Airports Authority	May 1999 to May 2001
Runway, Taxiway and Apron overlay in Tan Son Nhat Airport	Tan Son Nhat Airport	Southern Airports Authority	Southern Airports Authority	Runway, Taxiway and Apron Overlay (Area 55,000sq.m)	1million USD	1999	Southern Airports Authority	October 1999 to Feb 2000

APPENDIX A
LIST OF PROJECTS IN AIR TRANSPORT

Maintenance Hanger Development Plan in Tan Son Nhat Airport	Tan Son Nhat Airport	Vietnam Airlines		To expand the maintenance hanger.	Not Available	Not Available	Not Available	Not Available
Y2K	Vietnam Air Traffic Management	Vietnam Air Traffic Management	Vietnam Air Traffic Management	To solve the Year 2000 problem	Not Available	Not Available	Not Available	Completed by Nov 99
CNS/ATM Project	Vietnam Air Traffic Management	Vietnam Air Traffic Management	Vietnam Air Traffic Management	To implement CNS/ATM	Not Available	Not Available	Not Available	Not Available
Vinh Airport Project	Vinh City	Northern Airports Authority		Improvement Plan	Not Available	Not Available	Not Available	Not Available
Automated Weather Observation System (AWOS) Installation in Regional Airports	Regional Airports	CAAV	CAAV	Install AWOS in regional Airports, List of the airports is not available.	Not Available	Not Available	Not Available	Not Available

APPENDIX B-1
Airport Inventory of Noi Bai International Airport

Item	Descriptions
Basic Data	
Airport Name	Noi Bai International Airport
Province	Hanoi
District	H. Soc Son
AIP/IATA Code	HAN
ICAO Classification	4E
Reference Point (WGS-84)	211318N 1054820E
Scheduled Flight (as of Apr 99)	Available
Operating Aircraft	310, 320, 733, 734, 763, AB3, AT7, F70, IL9
Location Relative to City (km and direction)	22km North of City
Operating Hours	24 Hours
Capable of Night Operations	Yes
Seasonal Availability	All Season
Elevation (m)	12 m
Reference Temperature (C)	32.9 C
Customs (Available or N/A)	Available
Immigration (Available or N/A)	Available
Runway	
Runway Designation	11/29
Wind Coverage 20kt	: 99.9%
Category	: Precision Approach CAT-I
Length	: 3,200 m
Width	: 45 m
Longitudinal Slope	: 0.007%
Clearway	: 400 x 300m
Runway Strip Length	: 3,320 m
Runway Strip Width	: 300 m
Surface	: Concrete
Strength	: PCN 55 R/C/X/T
Taxiway	
Configuration	Y-shaped connecting and complete parallel with two exit
Width	30
Surface	Concrete
Strength	PCN 55 R/C/X/T
Apron	
Name	A1 : A2
Purpose	: Passenger : Passenger
Area	: 99,000 sq.m : 44,384 sq.m
Width	: N/A m : 292 m
Depth	: N/A m : 152 m
Surface	: Concrete : Concrete
Strength	: PCN 55 R/C/X/T : PCN 55 R/C/X/T
Parking Position	: 4 x B747, 3 x B767, 10 x A320/B737, 40 x ATR72 :
Name (No.3 and No.4)	A3
Purpose	: Passenger
Area	: 21,840 sq.m
Width	: 280 m
Depth	: 78 m

(APPENDIX B-1 continued)

Item	Descriptions
Surface	: Concrete
Strength	: PCN 55 R/C/X/T
Parking Position	:
Passenger Terminal Building	
Name	T1
Purpose	: International and Domestic Passenger
Area	: 77,000 sq.m
Structure	:
Total Area	77,000 Sq.m
Cargo Terminal Building	
Area	: 1,624
Fire Station	
Area	: N/A
Maintenance Building	
Area	5,600 sq.m
Radio Navigation Aids	
NDB	Available
VOR/DME	Available
ILS Category	CAT-I
ILS LLZ	RWY11
ILS GP	RWY11
ILS MM	RWY11
ILS OM	RWY11
SSR	Not Available
PSR	Available
Airfield Lighting	
Precision Approach Lights	RWY11
Simple Approach Lights	
PAPI	RWY11/29
VASIS	
RWY Edge	Available
RWY Threshold and End	RWY11/29
TWY Edge	Available
Stop Bar Light	Available
Aerodrome Beacon	Available
Apron Flood Light	Available
Meteorological Equipment	
Wind Cone	Available
Automated Weather Observation System	Available
Rescue and Fire Fighting System	
Available Category	9
No. Trained Person	40
No. Major FFV	3
Water Capacity -FFV [l]	10,000 10000 10000 2400 6000
Foam Capacity-FFV[l]	500 500 500 1500
Chemical Capacity-FFV [kg]	
Discharge Rate-FFV [l/hr]	3.78 L/m 3.78 L/m 3.78 L/m 2400 L/m
Ambulance	1

(APPENDIX B-1 continued)

Item	Descriptions		
Power Supply System			
Supply System	National power network		
Transformer Capacity [kva]	12000		
Receiving Voltage [kV]	35		
Number of Generator	3		
Generator Capacity	3000	590	590
Generator for	Terminal, Navigation Equipment Meteorology	Air Traffic Service	Air Traffic Service
Utilities			
Water Source	Deep well		
Water Capacity [kl/day]	3,000		
Sewage System	Septic Tank		
Solid Waste Disposal System	Dumping outside the airport		
Fuel Supply System	Tanker		
Fuel Storage [kl]	8,000		
Fuel Operator	Vietnam Air Petrol Company		

APPENDIX B-2
Airport Inventory of Danang International Airport

Item	Descriptions			
Basic Data				
Airport Name	Danang International Airport			
Province	Da Nang			
District				
AIP/IATA Code	VVDN/DAD			
Reference Point (WGS-84)	160238N	1081201E		
Scheduled Flight (as of Apr 99)	Available			
Operating Aircraft	320, AT7, F70, M80			
Location Relative to City (km and direction)	3.2km SW from city			
Operating Hours	24 Hours			
Capable of Night Operations	Yes			
Seasonal Availability	All Season			
Elevation (m)	8.00 m			
Reference Temperature (C)	35 C			
Customs (Available or N/A)	Available			
Immigration (Available or N/A)	Available			
Runway				
Runway Designation	17L/35R		17R/35L	
Wind Coverage 20kt	:		:	
Category	:	Precision Approach CAT-I 35R	:	Non Precision
Length	:	3,048 m		3,048 m
Width	:	45 m	:	45 m
Longitudinal Slope	:	N/A	:	N/A
Clearway	:		:	
Runway Strip Length	:	3,658 m	:	3,658 m
Runway Strip Width	:	150 m	:	150 m
Surface	:	Asphalt	:	Asphalt
Strength	:	PCN 46 F/A/W/T	:	PCN 46 F/V/W/T
Taxiway				
Configuration	Complete parallel with 4 exit			
Width	25			
Surface	Asphalt			
Strength	PCN 30 F/B/XX/U			
Apron				
Name				
Purpose	:	Passenger	:	Passenger
Area	:	73,458 sq.m	:	43,840 sq.m
Width	:	462 m	:	320 m
Depth	:	159 m	:	137 m
Surface	:	Concrete	:	Concrete
Strength	:	PCN 30 F/B/X/U	:	PCN 30 F/B/X/U
Parking Position	:	1xB747, 3xA320, 7xATR72	:	

(APPENDIX B-2 continued)

Item	Descriptions			
Passenger Terminal Building				
Name				
Purpose	:	International Passenger	:	Domestic Passenger
Area	:	2,148 sq.m	:	4,554 sq.m
Structure	:	Two Story RC	:	Two Story RC
Total Area	6,702	sq.m		
Cargo Terminal Building				
Structure	:	One Story Steel		
Area	:	600		
Fire Station				
Area	:	N/A		
Carpark and Access Road				
Parking Position	100			
Surface	Asphalt			
Access Road Lane	2 lane for each direction			
Surface	Asphalt			
Radio Navigation Aids				
NDB	x2			
VOR/DME	Available			
ILS Category	CAT-1 (35R)			
ILS LLZ	35R			
ILS GP	35R			
ILS MM	Not Available			
ILS OM	Not Available			
SSR	Available			
PSR	Available			
Airfield Lighting				
Precision Approach Lights	Not Available			
Simple Approach Lights	RWY 35R			
PAPI	RWY 35R/17L			
VASIS	Not Available			
RWY Edge	Available			
RWY Threshold and End	RWY 35R/17L			
TWY Edge	Available			
Stop Bar Light	Not Available			
Aerodrome Beacon	Available			
Apron Flood Light	Available			
Meteorological Equipment				
Wind Cone	Available			
Automated Weather Observation System	Available			

(APPENDIX B-2 continued)

Item	Descriptions					
Rescue and Fire Fighting System						
Available Category	7					
No. Trained Person	14					
No. Major FFV	3					
Water Capacity -FFV [l]	8,000	2000	1360			
Foam Capacity-FFV[l]	1,000	200	1500			
Chemical Capacity-FFV [kg]	250	50				
Discharge Rate-FFV [l/hr]	6,000 L/m	2,400 L/m	6,800 L/m			
Ambulance						
Power Supply System						
Supply System	from city network					
Transformer Capacity [kva]	1,440					
Receiving Voltage [kV]						
Number of Generator	5					
Generator Capacity	560	250	250	250	135	
Generator for	Terminal and Office	Control Tower	Air Field Lighting	ILS VOR/DME	AWOS	
Utilities						
Water Source	from city network					
Water Capacity [kl/day]	1,000 ton/day					
Sewage System	No					
Solid Waste Disposal System	Waste bin					
Fuel Supply System	Fuel Truck					
Fuel Storage [kl]	5,200					
Fuel Operator	Vietnam Air Petrol Company					

APPENDIX B-3
Airport Inventory of Tan Son Nhat International Airport

Item	Descriptions			
Basic Data				
Airport Name	Tan Son Nhat International Airport			
Province	Ho Chi Minh			
District				
AIP/IATA Code	SGN			
Reference Point (WGS-84)	104914N 1063939E			
Scheduled Flight (as of Apr 99)	Available			
Operating Aircraft	310, 320, 330, 343, 733, 734, 747, 763, 767, AB3, AT7, D10, F70, M80			
Location Relative to City (km and direction)	6.0km NW of City Central Church			
Operating Hours	24 Hours			
Capable of Night Operations	Yes			
Seasonal Availability	All Season			
Elevation (m)	10.00 M			
Reference Temperature (C)	35.2 C			
Customs (Available or N/A)	Available			
Immigration (Available or N/A)	Available			
Runway				
Runway Designation	07R/25L		07L/25R	
Wind Coverage 20kt	:		:	
Category	:	Non-precision instrument	:	Precision Cat-I
Length	:	3,036 m		3,045 m
Width	:	45 m	:	45 m
Longitudinal Slope	:	0.080%	:	
Stopway	:		:	
Clearway	:		:	
Runway Strip Length	:	3,666 m	:	3,668 m
Runway Strip Width	:	300 m	:	150 m
Surface	:	Concrete	:	Concrete
Strength	:	PCN 50 R/B/X/U	:	PCN 60/R/B/X/U
Taxiway				
Configuration	Parallel with 8 exits (07R/25L) 5 exits (07L/25R)			
Width	23			
Surface	Concrete and Asphalt			
Strength	PCN 50 R/B/X/U			
Apron				
Name				
Purpose	:	Passenger	:	Passenger
Area	:	56,875 sq.m	:	75,000 sq.m
Width	:	325 m	:	500 m
Depth	:	175 m	:	150 m
Surface	:	Concrete	:	Concrete
Strength	:	PCN 50 R/B/X/U	:	PCN 50 R/B/X/U
Parking Position	:	10 x B747	:	4 x B767, 6 x A320
Name (No.3 and No.4)				
Purpose	:	Passenger	:	Passenger
Area	:	21,875 sq.m	:	8,750 sq.m
Width	:	175 m	:	175 m
Depth	:	125 m	:	50 m
Surface	:	Concrete	:	Concrete

(APPENDIX B-3 continued)

Item	Descriptions			
Strength	:	PCN 50 R/B/X/U	:	PCN 50 R/B/X/U
Parking Position	:	8 x ATR72	:	3 x YK40
Total Area		162500 sq.m		
Passenger Terminal Building				
Name				
Purpose	:	International Passenger	:	Domestic Passnger
Area	:	24,000 sq.m	:	7,000 sq.m
Structure	:	RC	:	RC
Total Area	31,000	sq.m		
Cargo Terminal Building				
Name	Cargo			
Area	:	22,000		
Structure	:	Steel		
Area	:	12,500		
Fire Station				
Area	:	N/A		
Carpark and Access Road				
Parking Position	300			
Surface	Asphalt			
Access Road Lane	2			
Surface	Asphalt			
Radio Navigation Aids				
NDB	Available			
VOR/DME	Available			
ILS Category	CAT-I			
ILS LLZ	RWY25R			
ILS GP	RWY25R			
ILS MM				
ILS OM				
SSR	Available			
PSR	Available			
Airfield Lighting				
Precision Approach Lights				
Simple Approach Lights	RWY 25L, 25R, 07L			
PAPI	RWY07R/25L, 07L/25R			
VASIS	RWY25L			
RWY Edge				
RWY Threshold and End	RWY07R/25L, 07L/25R			
TWY Edge	Available			
Stop Bar Light				
Aerodrome Beacon	Available			
Apron Flood Light	Available			
Meteorological Equipment				
Wind Cone	Available			
Automated Weather Observation System	Available			

(APPENDIX B-3 continued)

Item	Descriptions			
Rescue and Fire Fighting System				
Available Category	8			
No. Trained Person	17			
No. Major FFV	3			
Water Capacity -FFV [l]	8,000	8,000	2400	
Foam Capacity-FFV[l]	1,000	1,000	1000	
Chemical Capacity-FFV [kg]				
Ambulance	5 (VA), 2 (Military)			
Power Supply System				
Supply System				
Transformer Capacity [kva]				
Receiving Voltage [kV]				
Number of Generator	4			
Generator Capacity	500	500	500	500
Generator for				
Utilities				
Water Source	Tan So Nhat City Water District			
Water Capacity [kl/day]	40,000cu.m / month			
Sewage System				
Solid Waste Disposal System				
Fuel Supply System	Refueler			
Fuel Storage [kl]	7,200			
Fuel Operator	VINAPCO			

APPENDIX B-4
Airport Inventory of Cat Bi Airport

Item	Descriptions
Basic Data	
Airport Name	Cat bi Airport
Province	Haiphong
District	Cat BI
AIP/IATA Code	HPH
Reference Point (WGS-84)	204915N 1064328E
Scheduled Flight (as of Apr 99)	Available
Operating Aircraft	320
Location Relative to City (km and direction)	4km
Operating Hours	HJ
Capable of Night Operations	No
Seasonal Availability	All Season
Elevation (m)	8.00 m
Reference Temperature (C)	32 C
Customs (Available or N/A)	N/A
Immigration (Available or N/A)	N/A
Runway	
Runway Designation	07/25
Wind Coverage 20kt	: 99.7% :
Category	: Non-precision :
Length	: 2,400 m m
Width	: 50 m : m
Longitudinal Slope	: :
Clearway	: No :
Runway Strip Length	: m : m
Runway Strip Width	: m : m
Surface	: Asphalt :
Strength	: PCN 36 F/C/X/T :
Taxiway	
Configuration	Connecting taxiway 116m x 18m
Width	18
Surface	Asphalt
Strength	N/A
Apron	
Name	
Purpose	: Passenger
Area	: 15,129 sq.m
Width	: 124 M
Depth	: 122.5 M
Surface	: Concrete
Strength	: PCN 38 F/C/X/T
Parking Position	: 2xB767, 2xA320, 4xATR72, 4xF70
Total Area	15,129 sq.m

(APPENDIX B-4 continued)

Item	Descriptions
Passenger Terminal Building	
Name	
Purpose	: Domestic Passenger
Area	: 1,945 sq.m
Structure	:
Total Area	1,945 sq.m
Fire Station	
Area	: N/A
Carpark and Access Road	
Parking Position	
Surface	Asphalt
Access Road Lane	2
Surface	Asphalt
Radio Navigation Aids	
NDB	Available
VOR/DME	Not Available
ILS Category	Not Available
ILS LLZ	Not Available
ILS GP	Not Available
ILS MM	Not Available
ILS OM	Not Available
SSR	Not Available
PSR	Not Available
Airfield Lighting	
Precision Approach Lights	Not Available
Simple Approach Lights	Not Available
PAPI	Not Available
VASIS	Not Available
RWY Edge	Not Available
RWY Threshold and End	Not Available
TWY Edge	Not Available
Stop Bar Light	Not Available
Aerodrome Beacon	Not Available
Apron Flood Light	Available
Meteorological Equipment	
Wind Cone	Available
Automated Weather Observation System	Available
Rescue and Fire Fighting System	
Available Category	
No. Trained Person	
No. Major FFV	1
Water Capacity -FFV [l]	8,000 4000
Foam Capacity-FFV[l]	1,500
Chemical Capacity-FFV [kg]	
Discharge Rate-FFV [l/hr]	13L/m
Ambulance	1

(APPENDIX B-4 continued)

Item	Descriptions
Power Supply System	
Supply System	from City Network
Transformer Capacity [kva]	
Receiving Voltage [kV]	
Number of Generator	
Generator Capacity	
Generator for	
Utilities	
Water Source	
Water Capacity [kl/day]	
Sewage System	Septic Tank
Solid Waste Disposal System	City Service
Fuel Supply System	
Fuel Storage [kl]	
Fuel Operator	

APPENDIX B-5
Airport Inventory of Phu Bai Airport

Item	Descriptions
Basic Data	
Airport Name	Phu Bai Airport
Province	Thua Thien Hue
District	Phu Bai
AIP/IATA Code	VVPB/HUI
Reference Point (WGS-84)	162357N 1074223E
Scheduled Flight (as of Apr 99)	Available
Operating Aircraft	AT7, F70
Location Relative to City (km and direction)	13km Southeast of City
Operating Hours	HJ
Capable of Night Operations	No
Seasonal Availability	All Season
Elevation (m)	13.45 m
Reference Temperature (C)	24 C
Customs (Available or N/A)	N/A
Immigration (Available or N/A)	N/A
Runway	
Runway Designation	09/27
Wind Coverage 20kt	:
Category	: Non-Precision
Length	: 2,700 m
Width	: 40 m
Longitudinal Slope	:
Stopway	: Paved 50m, unpaved 200m RWY27, paved 30m RWY09
Clearway	:
Runway Strip Length	: 2,780 m
Runway Strip Width	: 300 m
Surface	: Asphalt
Strength	: PCN 42 F/B/W/T
Taxiway	
Configuration	Partial parallel taxiway with 2 exits
Width	18
Surface	Asphalt
Strength	59 tons
Apron	
Name	
Purpose	: Passenger
Area	: 42,000 sq.m
Width	: 350 m
Depth	: 120 m
Surface	: Asphalt
Strength	:
Parking Position	: 6 x ATR72/F70
Total Area	42,000 sq.m

(APPENDIX B-5 continued)

Item	Descriptions
Passenger Terminal Building	
Purpose	: Passenger
Area	: 2,000 sq.m
Structure	: Two story RC
Total Area	2,000 sq.m
Fire Station	
Area	: N/A
Carpark and Access Road	
Parking Position	60
Surface	Asphalt
Access Road Lane	1 lane for each direction
Surface	Asphalt
Radio Navigation Aids	
NDB	x 2
VOR/DME	Not Available
ILS Category	Not Available
ILS LLZ	Not Available
ILS GP	Not Available
ILS MM	Not Available
ILS OM	Not Available
SSR	Not Available
PSR	Not Available
Airfield Lighting	
Precision Approach Lights	Not Available
Simple Approach Lights	Not Available
PAPI	Not Available
VASIS	Not Available
RWY Edge	Not Available
RWY Threshold and End	Not Available
TWY Edge	Not Available
Stop Bar Light	Not Available
Aerodrome Beacon	Not Available
Apron Flood Light	Not Available
Meteorological Equipment	
Wind Cone	Available
Automated Weather Observation System	Available

(APPENDIX B-5 continued)

Item	Descriptions
Rescue and Fire Fighting System	
Available Category	5
No. Trained Person	8
No. Major FFV	2
Water Capacity -FFV [l]	2,800 5800
Foam Capacity-FFV[l]	400
Chemical Capacity-FFV [kg]	200
Discharge Rate-FFV [l/hr]	2500l/min
Ambulance	1
Power Supply System	
Supply System	from national network
Transformer Capacity [kva]	250
Receiving Voltage [kV]	
Number of Generator	5
Generator Capacity	250 22 22
Generator for	Tower NDB NDB
Utilities	
Water Source	City network
Water Capacity [kl/day]	Pipe diameter 1.3m
Sewage System	Open channel
Solid Waste Disposal System	Dumping inside the airport
Fuel Supply System	Tanker
Fuel Storage [kl]	80
Fuel Operator	VINAPCO

APPENDIX B-6
Airport Inventory of Nha Trang Airport

Item	Descriptions			
Basic Data				
Airport Name	Nhat Tang Airport			
Province	Khanh Hoa			
District	TP. Nha Trang			
AIP/IATA Code	NHA			
Reference Point (WGS-84)	121323N	1091200E		
Scheduled Flight (as of Apr 99)	Available			
Operating Aircraft	AT7			
Location Relative to City (km and direction)	2km from Nha Trang City			
Operating Hours	HJ			
Capable of Night Operations	No			
Seasonal Availability	All Season			
Elevation (m)	6.08 m			
Reference Temperature (C)	25 C			
Customs (Available or N/A)	N/A			
Immigration (Available or N/A)	N/A			
Runway				
Runway Designation	05/23		12/30	
Wind Coverage 20kt	:		:	
Category	:		:	
Length	:	1,250 m		1,860 m
Width	:	50 m	:	45 m
Longitudinal Slope	:		:	
Stopway	:		:	
Clearway	:		:	
Runway Strip Length	:	m	:	m
Runway Strip Width	:	m	:	m
Surface	:	Asphalt	:	Asphalt
Strength	:	Up to 20t	:	Up to 40t
Taxiway				
Configuration	Complete parallel taxiway for RWY12/30 with 5 exits			
Width	15			
Surface	Asphalt			
Strength	less than 50t			
Apron				
Name				
Purpose	:	Passenger		
Area	:	15,000 sq.m		
Width	:	150 m		
Depth	:	100 m		
Surface	:	Asphalt		
Strength	:	less than 50t		
Parking Position	:	4 x ATR72 or F70		
Total Area		15,000 sq.m		

(APPENDIX B-6 continued)

Item	Descriptions
Passenger Terminal Building	
Name	
Purpose	: Domestic Passenger
Area	: 1,500 sq.m
Structure	:
Total Area	1,500 sq.m
Fire Station	
Area	:
Carpark and Access Road	
Parking Position	
Surface	Asphalt
Access Road Lane	Dual
Surface	Asphalt
Radio Navigation Aids	
NDB	Available
VOR/DME	Not Available
ILS Category	Not Available
ILS LLZ	Not Available
ILS GP	Not Available
ILS MM	Not Available
ILS OM	Not Available
SSR	Not Available
PSR	Not Available
Airfield Lighting	
Precision Approach Lights	Not Available
Simple Approach Lights	Not Available
PAPI	Not Available
VASIS	Not Available
RWY Edge	Not Available
RWY Threshold and End	Not Available
TWY Edge	Not Available
Stop Bar Light	Not Available
Aerodrome Beacon	Not Available
Apron Flood Light	Not Available
Meteorological Equipment	
Wind Cone	Available
Automated Weather Observation System	Not Available
Rescue and Fire Fighting System	
Available Category	Not Available
Ambulance	Not Available
Power Supply System	
Supply System	National Power Network
Transformer Capacity [kva]	125
Receiving Voltage [kV]	
Number of Generator	3
Generator Capacity	150 5 5
Generator for	Terminal Building NDB NDB

(APPENDIX B-6 continued)

Item	Descriptions
Utilities	
Water Source	Deep well
Water Capacity [kl/day]	
Sewage System	Septic Tank
Solid Waste Disposal System	Collect by other enterprise
Fuel Supply System	
Fuel Storage [kl]	
Fuel Operator	Vietnam Air Petrol Company

APPENDIX C
VIETNAM CNS/ATM TRANSITION AND IMPLEMENTATION PLAN

Communication Network Transition															
Applied technical solution	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
– To utilize satellite communication service AMSS in areas without VHF coverage.				To be tested											
– To utilize fixed telephone communication service in VHF coverage areas.					To be applied										
– To set up an aeronautical telecommunications network ATN using bit direction-finding to establish transition procedure with high speed.				To be tested					To be applied						

APPENDIX C
VIETNAM CNS/ATM TRANSITION AND IMPLEMENTATION PLAN

Navigation System Transition															
Applied technical solution	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
• En-route															
– To introduce WGS-84 coordinates.								To be applied							
– To utilize regional navigation RNAV/RNP (required navigation performance)			To be tested					To be applied							
– To utilize GNSS				To be tested					To be applied						
• Non-precision approach.															
– To utilize GNSS				To be tested					To be applied						
• Precision landing approach															
– To utilize instrument landing system ILS									Continue to be applied						
– To utilize GNSS: WAAS and LAAS.										To be tested					
													To be applied		

APPENDIX C
VIETNAM CNS/ATM TRANSITION AND IMPLEMENTATION PLAN

Surveillance & Communication Transition															
Applied technical solution	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
- To utilize automatic dependent surveillance (ADS) through AMSS to the areas without radar-coverage				To be tested							To be applied				
- Follow up utilization and improvement of the existing radar system.											Continue to be applied and improved				

APPENDIX C
VIETNAM CNS/ATM TRANSITION AND IMPLEMENTATION PLAN

Air Traffic Management Transition															
Applicable technical solution	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
– To establish a procedure of flight flow management and harmonization.			The procedure is to be set up and applied												
– To establish a flight performance procedure using RNAV/ RNP					The procedure is to be set up and applied										
– To set up an en-route flight procedure using GNSS			To be supplemented		To be applied										
– To set up an en-route flight performance precision and nonprecision landing approach using GNSS					The procedure is set up			To be applied							
– To set up an automatic dependent surveillance.				To be supplemented		To be applied									
– To reduce standard of height seperation from 2,000 feet (600 m) down to 1,000 feet (300 m) flight level FL 290							To be applied								

APPENDIX C
VIETNAM CNS/ATM TRANSITION AND IMPLEMENTATION PLAN

On-Board Transition															
Applicable technical solution	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
– To introduce responsibility of airborne collisions. Avoidance system in the area of Vietnam								The procedure is set up and applied							
– Satellite communication AMSS								To be applied							
– VHF data transmission								To be applied							
– Proposed navigation particularity, inertia navigation system, flight management system.											To be applied				
– Global navigation satellite system.									To be applied						
– Automatic dependent surveillance									To be applied						

APPENDIX D
CAPACITY OF PASSENGER TERMINAL BUILDINGS

1. Domestic Passenger Terminal

Capacity of the domestic passenger terminal buildings are estimated with the following formula:

$$UC = FA \times \frac{1}{UFA} \times PHR \times PDR \times 200\%$$

Where,
UC: Capacity of domestic passenger terminal building [Annual Passenger]
FA: Floor area of passenger terminal building [sq.m]
UFA: Unit floor area per peak hour passengers (15sq.m/peak hour passengers)
PHR: Peak hour ratio ($4.4891 \times PHP^{-0.3996}$)
PHP: Peak hour passengers (FA/UFA)
PDR: Peak day ratio (300)

It is presumed that capacity of the passenger terminal building is 200% of design capacity.

2. International Passenger Terminal

Capacity of the domestic passenger terminal buildings are estimated with the following formula:

$$UC = FA \times \frac{1}{UFA} \times PHR \times PDR \times 200\%$$

Where,
UC: Capacity of domestic passenger terminal building [Annual Passenger]
FA: Floor area of passenger terminal building [sq.m]
UFA: Unit floor area per peak hour passengers (20sq.m/peak hour passengers)
PHR: Peak hour ratio ($501.91 \times PHP^{-0.979}$)
PHP: Peak hour passengers (FA/UFA)
PDR: Peak day ratio (300)

It is presumed that capacity of the passenger terminal building is 200% of design capacity.

Table D-1. Estimated Capacity of Existing Passenger Terminal Building

Airport Name	DPT Floor Area [sq.m]	Estimated DPT Capacity [Annual Pax]	IPT Floor Area [sq.m]	Estimated IPT Capacity [Annual Pax]
Noi Bai	38,500	7,902,154	38,500	3,779,321
Cat Bi	1,942	120,828	0	0
Nasan	550	22,000	0	0
Dienbien	500	20,000	0	0
Vinh	570	22,800	0	0
Phubai	2,000	125,909	0	0
Danang	4,554	398,310	2,148	64,440
Phucat	500	20,000	0	0
Nhatrang	1,500	84,177	0	0
Pleiku	1,000	47,724	0	0
Buon Ma Thuot	1,380	74,905	0	0
Tan Son Nhat	7,000	726,999	24,000	1,483,287
Lienkhuong	720	30,134	0	0
Rachgia	578	23,120	0	0
Phu Quoc	700	28,969	0	0
Ca Mau	158	6,330	0	0

APPENDIX E
OTHER AIRLINES' AIRCRAFT USAGE

		Average Block Time Flow			Dom/Intl	Jet/Turboprop
		Per Day		Annual [hours]		
Japan Airlines	DC-10-40	8:	05	2,950	Dom&Intl	Jet
	B747-100/200/300	11:	32	4,210	Intl	Jet
	B747-400	11:	00	4,015	Intl	Jet
	B747-100F/200F	12:	33	4,581	Intl	Jet
	B747SR	7:	54	2,884	Dom	Jet
	B767-200/300	7:	08	2,604	Dom	Jet
	MD-11	9:	27	3,449	Intl	Jet
	B737-400	4:	29	1,636	Dom	Jet
Philippine Airlines	B747-200	9:	11	3,352	Intl	Jet
	B747-400	13:	47	5,031	Intl	Jet
	DC-10	4:	51	1,770	Dom	Jet
	A300	5:	55	2,160	Dom	Jet
	B737-400	7:	22	2,689	Dom	Jet
	F50	4:	57	1,807	Dom	Turboprop
Garuda Indonesia	DC-10-30	7:	35	2,768	Dom&Intl	Jet
	A300-B4	4:	05	1,490	Dom	Jet
	A300-600R	8:	57	3,267	Intl	Jet
	B737-400	6:	51	2,500	Dom&Intl	Jet
	B737-300	6:	40	2,433	Dom&Intl	Jet
	B747-400	14:	46	5,390	Intl	Jet
	B747-200	10:	23	3,790	Intl	Jet
	MD-11	12:	59	4,739	Intl	Jet
	F28	1:	17	468	Dom	Turboprop
Thai Airways	B747-200	7:	48	2,847	Intl	Jet
	B747-300	11:	06	4,052	Intl	Jet
	B747-400	13:	06	4,782	Intl	Jet
	DC-10-30	10:	54	3,979	Intl	Jet
	A300-B4	7:	18	2,665	Dom	Jet
	A300-600R	8:	48	3,212	Intl	Jet
	A330-300	8:	04	2,944	Dom&Intl	Jet
	A310-200	6:	06	2,227	Dom&Intl	Jet
	B737-400	5:	54	2,154	Dom&Intl	Jet
	MD-11	8:	42	3,176	Dom&Intl	Jet
	ATR72	3:	42	1,351	Dom	Turboprop
	ATR42	4:	48	1,752	Dom	Turboprop
	BAe 146-300	3:	36	1,314	Dom	Jet

Source: IATA World Air Transport Statistics (WATS) No. 40

APPENDIX F
METHODS FOR AIRCRAFT MOVEMENTS FORECAST AND PEAK HOUR FORECAST & FACILITY REQUIREMENT

1 Methods for Aircraft Movements Forecast and Peak Hour Forecast

1.1 Aircraft Movements Forecast

The forecast of aircraft movements depends on how airlines will meet the forecast annual passenger demand by increasing frequencies and/or introducing larger aircraft. In general, larger aircraft are used as demand on trunk routes rises, while airlines tend to increase frequencies rather than aircraft size where intense competition exists.

In the absence of competition, airlines introduce larger aircraft and reduce service frequencies to save operating costs. The deregulation of the domestic air market will be expected in the near future in Vietnam so that future aircraft movements are estimated based on a liberalized air service.

1) International Aircraft Movements

The following aircraft mix at major Asian international airports may be grouped as follows:

JJ (Jumbo Jet)	350 seats	B747, B777, A340, A330, etc.	40%
LJ (Large Jet)	250 seats	MD-11. L1011, B767-300, etc.	30%
MJ (Medium Jet)	200 seats	B767-200, A310, etc.	15%
SJ (Small Jet)	140 seats	A320, B737, etc.	15%
TP (Turboprop)	70 seats	ATR72, etc.	0%

Given the above characteristics common to major Asian airports, Figure 1.1 is used to calculate the average load in the three international airports. With this increasing trend of average load and assumed annual average load factor of 70%, the aircraft mix of international traffic in the three international airports can be given as shown in Figure 1.2.

Figure 1.1 Relationship between Annual International Passenger Traffic and Average Load

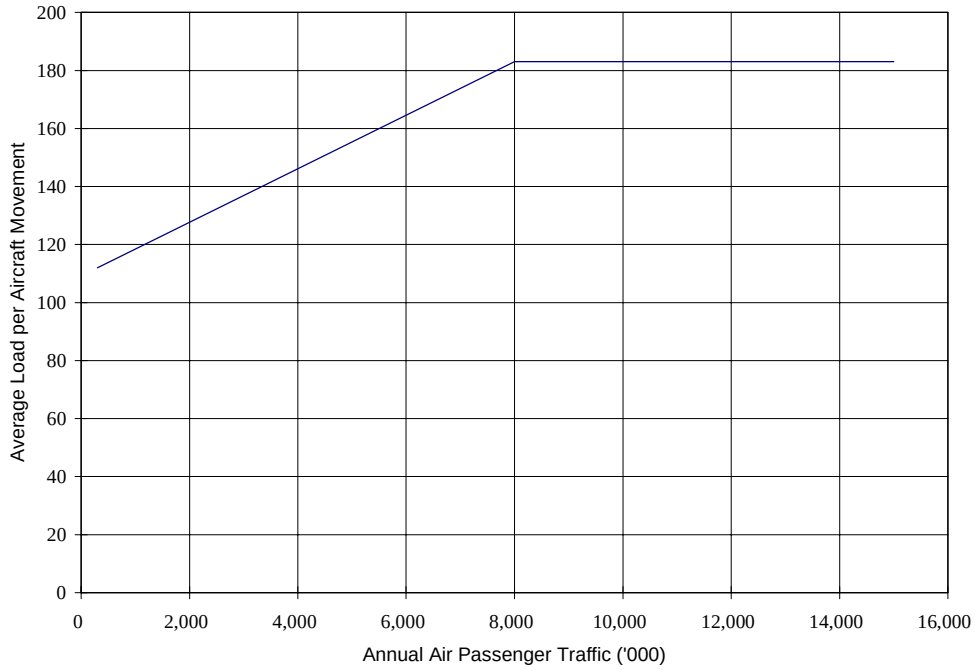
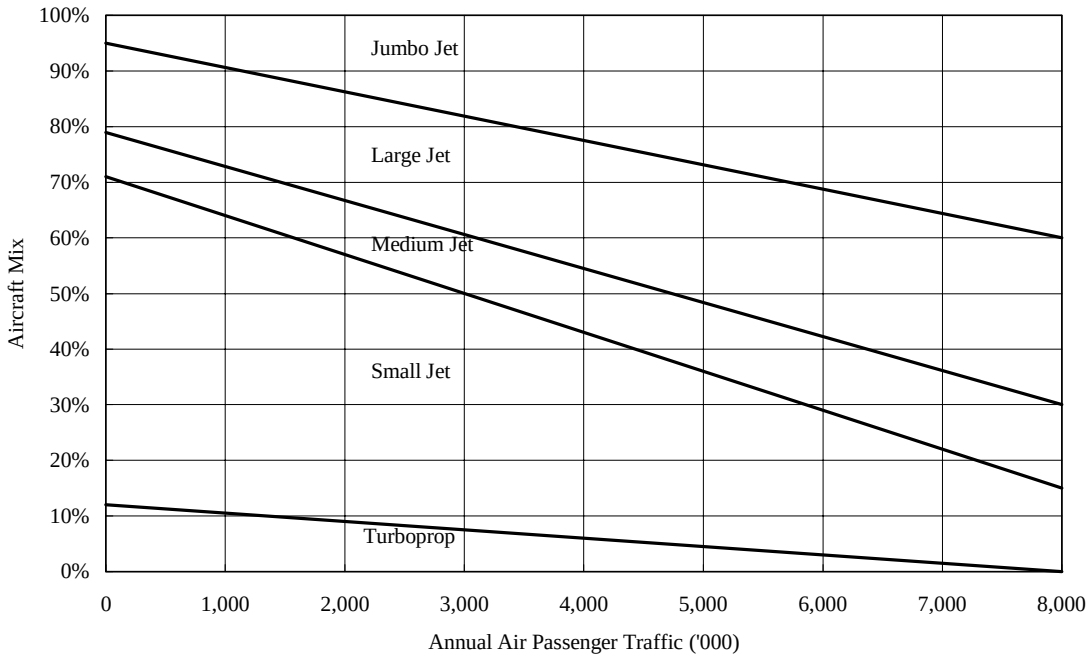


Figure 1.2 Future Mix of International Aircraft



The annual international aircraft movements in the three international airports are calculated by dividing the forecast annual number of international passengers by the corresponding average load in Figure 1.1. The results are shown below.

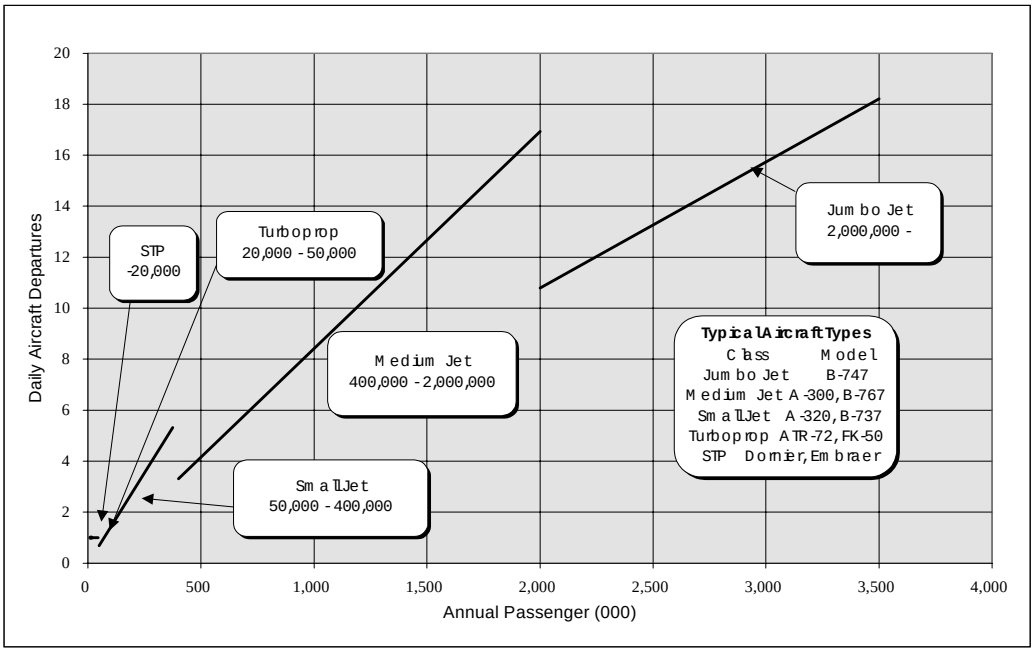
Table 1.1 International Annual Aircraft Movements Forecast in the Three International Airports

	2010						2020					
	JJ	LJ	MJ	SJ	TP	Total	JJ	LJ	MJ	SJ	TP	Total
Hanoi	1,887	2,757	1,596	6,966	1,306	14,512	4,739	5,213	2,844	9,005	1,896	23,697
Danang	195	520	325	1,851	357	3,248	1,287	1,824	1,180	5,364	1,073	10,728
Tan Son Nhat	9,051	8,381	4,358	10,057	1,676	33,523	19,340	14,021	7,736	6,769	483	48,349

2) Domestic Aircraft Movements

Based on airline preferences and criterion used by the JCAB, it is reasonable to forecast that medium-size jet aircraft (A-300, B767) will be used for sectors carrying more than 400,000 passengers, while jumbo aircraft will not be used until the sector threshold of two million passengers per annum is reached (refer to Figure 1.3). At volumes below these levels, frequent service will evolve using small-size jet aircraft (A-320, B-737) and turboprops (ATR-72, F-50). It is also expected that smaller turboprop aircraft will be used to capture thin demand sectors.

Figure 1.3
Representative Air Industry Practices Aircraft Type, Flight Frequency and Domestic Demand



Applying, on a sector by sector basis and using an average load factor of 65%, the aircraft use criterion to forecast domestic demand results in estimates of annual aircraft movements as shown in Table 1.2.

Table 1.2 Annual Aircraft Movements

Airport Name	2010						2020					
	LJ	MJ	SJ	TP	STP	Total	LJ	MJ	SJ	TP	STP	Total
Noi Bai	9709	3706	1662	1797	730	17604	18110	5278	2396	6065	758	32607
Cat Bi	0	0	1670	553	702	2925	0	0	2254	2471	0	4725
Cao Bang	0	0	0	0	0	0	0	0	0	553	0	553
Lao Cai	0	0	0	0	0	0	0	0	0	622	0	622
Nasan	0	0	0	0	730	730	0	0	0	622	0	622
Dienbien	0	0	0	708	0	708	0	0	0	1037	0	1037
Vinh	0	0	0	536	702	1238	0	0	0	1918	0	1918
Dong Hoi	0	0	0	0	0	0	0	0	0	622	0	622
Phubai	0	0	2343	0	702	3045	0	0	3362	1157	1488	6007
Chu Lai	0	0	0	0	0	0	0	0	0	2402	0	2402
Danang	0	7390	0	2488	702	10580	0	10246	524	3388	899	15057
Phucat	0	0	0	650	0	650	0	0	0	857	1303	2160
Tuy Hoa	0	0	0	0	0	0	0	0	0	0	674	674
Nhatrang	0	0	1647	881	0	2528	0	0	2733	518	0	3251
Pleiku	0	0	562	536	0	1098	0	0	734	726	0	1460
Buon Ma Thuot	0	0	532	1071	0	1603	0	0	719	1538	758	3015
Tan Son Nhat	9709	3684	5092	2568	473	21526	18110	4968	6882	4779	960	35699
Lienkhuong	0	0	0	1037	0	1037	0	0	0	1469	758	2227
Rachgia	0	0	0	0	473	473	0	0	0	0	612	612
Phu Quoc	0	0	0	881	0	881	0	0	0	1140	0	1140
Ca Mau	0	0	0	0	0	0	0	0	0	1002	0	1002

1.2 Peak Hour Forecast

Peak hour estimates of aircraft movements are required for detailed planning of airport facilities and capacity. The following JCAB criteria (following formulas) are used to calculate peak day and peak hour aircraft movement:

(Peak Day Aircraft Movement) = (Annual Aircraft Movement) x 1/300

(Peak Hour Factor) = (1.51 / (Daily Two-way Aircraft Movements)) + 0.115

Peak hour passengers are estimated based on forecast peak hour aircraft movements and used a peak hour load factor of 75%.

Peak hour domestic aircraft movements, international aircraft movements and peak hour passengers are shown in Table 1.3, 1.4 and 1.5, respectively.

Table 1.3 Peak Hour Domestic Aircraft Movements

Airport Name	Peak Hour Domestic Aircraft Movement											
	2010						2020					
	LJ	MJ	SJ	TP	STP	Total	LJ	MJ	SJ	TP	STP	Total
Noi Bai	5	3	2	2	2	14	8	4	2	4	2	20
Cat Bi	0	0	2	2	2	6	0	0	2	2	0	5
Cao Bang	0	0	0	0	0	0	0	0	0	2	0	2
Lao Cai	0	0	0	0	0	0	0	0	0	2	0	2
Nasan	0	0	0	0	2	2	0	0	0	2	0	2
Dienbien	0	0	0	2	0	2	0	0	0	2	0	2
Vinh	0	0	0	2	2	3	0	0	0	2	0	2
Dong Hoi	0	0	0	0	0	0	0	0	0	2	0	2
Phubai	0	0	2	0	2	4	0	0	3	2	2	7
Chu Lai	0	0	0	0	0	0	0	0	0	2	0	2
Danang	0	4	0	2	2	9	0	5	2	3	2	12
Phucat	0	0	0	2	0	2	0	0	0	2	2	4
Tuy Hoa	0	0	0	0	0	0	0	0	0	0	2	2
Nhatrang	0	0	2	2	0	4	0	0	3	2	0	4
Pleiku	0	0	2	2	0	3	0	0	2	2	0	4
Buon Ma Thuot	0	0	2	2	0	4	0	0	2	2	2	6
Tan Son Nhat	5	3	3	2	2	16	8	3	4	3	2	21
Lienkhuong	0	0	0	2	0	2	0	0	0	2	2	4
Rachgia	0	0	0	0	2	2	0	0	0	0	2	2
Phu Quoc	0	0	0	2	0	2	0	0	0	2	0	2
Ca Mau	0	0	0	0	0	0	0	0	0	2	0	2

Table 1.4 Peak Hour International Aircraft Movements

Airport Name	Peak Hour Aircraft Movement											
	2010						2010					
	JJ	LJ	MJ	SJ	TP	Total	JJ	LJ	MJ	SJ	TP	Total
Noi Bai	2	3	2	4	2	13	3	4	3	5	2	17
Danang	1	2	1	2	1	7	2	2	2	4	2	12
Tan Son Nhat	5	5	3	5	2	20	9	7	4	4	2	26

Table 1.5 Peak Hour Passengers

Airport Name	Domestic		International	
	2010	2020	2010	2020
Noi Bai	2,353	3,465	1,802	2,425
Cat Bi	354	361		
Cao Bang	0	78		
Lao Cai	0	80		
Nasan	50	80		
Dienbien	81	87		
Vinh	128	102		
Dong Hoi	0	80		
Phubai	303	441		
Chu Lai	0	111		
Danang	922	1,311	849	1,327
Phucat	80	140		
Tuy Hoa	0	50		
Nhatrang	309	346		
Pleiku	259	269		
Buon Ma Thuot	267	333		
Tan Son Nhat	2,501	3,604	3,123	3,675
Lienkhuong	87	145		
Rachgia	47	49		
Phu Quoc	84	89		
Ca Mau	0	86		

2 Facility Requirement

2.1 Runway

Runway length requirement for each airport class is assumed to be the sufficient length for maximum takeoff weight of each aircraft corresponding to airport class.

Runway dimensions, such as runway width and runway shoulder, should follow ICAO recommendations.

By comparing the runway length requirement with future and existing runway lengths, runway extension will be required at Noi Bai, Dienbien, Vinh, Phu Bai, Danang, Nhatrang, Tan Son Nhat, Rachgia, Phu Quoc, Can Tho, and Ca Mau airports. A detailed study would be required to estimate the required runway length of each airport.

2.2 Apron

The required number of aircraft stands for loading and unloading passengers is calculated based on the number of aircraft movements during peak hour and the gate occupancy times of aircraft. The following formula is used in this study:

$$S = \sum_{i}^{n} \frac{Ti}{60} \times Ni \times a + b$$

Where S : Number of loading stands
Ti : Stand occupancy time in minutes of aircraft group *i*
Ni : Number of aircraft movement of aircraft group i during peak hour
a : Spare time ratio for emergency (=1.2)
b : Number of extra aircraft stands (one stand for each 10 stands)

Stand occupancy times vary depending on international or domestic services, aircraft type and other factors. In this study, 60 minutes, 50 minutes and 30 minutes are applied respectively for medium-size jet, small jet and turboprop and small turboprop aircraft.

The size of aircraft stands depends on aircraft parking configurations. The self-maneuvering method, i.e., power-in and power-out, is assumed to be used for small jet and turboprop aircraft. The tractor-assisted method, i.e., nose-in and push-out, is assumed to be used for medium-size jet.

The following JCAB standard size of apron is used in this study:

Table 2.1 JCAB Standard of Apron Area

Aircraft Type	Large Jet	Medium-size Jet	Small Jet	Turboprop	Small Aircraft
Area (sq m)	9,450	6,600	5,100	3,850	1,400

The required area of apron is calculated by multiplying the required number of spots and required area of each spot. Apron expansion will be required at Na San, Dien Bien, Phu Bai, Phu Cat, and Lienkhuong airports.

2.3 Passenger Terminal Building

The required total floor area of the passenger terminal building is calculated based on the number of peak hour passengers and a unit floor area requirement per passenger. The following formula is used in this study:

$A = U \times P$

Where, A: Required total floor area of a passenger terminal building (sq m)
U: Unit floor area requirement (= 15 sq m for domestic and 20 sq m for international)
P: Peak hour number of passengers (two-way)

Based on this calculation, the required and current floor areas of passenger terminal building were compared. Based on the result, the expansion or construction of a new passenger terminal building will be required in all airports.

2.4 Cargo Terminal Building

There is no cargo terminal area in all the airports except in the three international airports. According to the forecast, cargo-handling facilities will be required by year 2020. In this study, separate cargo terminal building is recommended for airports handling cargo volumes of more than 2,000 tons annually.[1] The floor area required for a cargo terminal building is calculated by the following formula:

$$A = V / U$$

Where, *A* : Required total floor area of a cargo terminal building (sq m)
U : Handling capacity (= 5 tons/sq m)
V : Annual cargo volume (ton)

Based on the result, a new cargo terminal building will be required at Noi Bai, Cat Bi, Thanh Hoa, Vinh, Phu Bai, Danang, Phucat, Nha Trang, Pleiku, Lienkuong, Phu Quoc, Can Tho, and Ca Mau airports.

2.5 Air Navigation Systems

It is reasonable to presume that the new CNS/ATM system will be operational by year 2010. Installation of the equipment for this system will be required.

2.6 Rescue and Fire-fighting System

As aircraft size operated in airports increases, the rescue and fire-fighting system should be upgraded. Though the data of rescue and fire-fighting system is not available at the time of the study in most of the regional airports, it is assumed that at least one fire-fighting vehicle is installed in each airport.

[1] JCAB guideline recommends a separate cargo terminal building for airports with more than 500-ton annual cargo volume. A separate forwarder building may be planned if annual cargo volume is greater than 5,000 tons and will become necessary if annual cargo volume exceeds 10,000 tons. Since the situation in Vietnam is different from that in Japan, the 2,000-ton threshold is used in this study.

2.7 Airfield Lighting System

Airfield lighting systems are currently installed in the three international airports. To improve safety operation, the installation of airfield lighting systems for day and night operation in Class III and Class II airports is recommended, respectively.

Table 2.2 Guidelines for Installation of Aeronautical Ground Lights

	Installation Guideline	Lighting Facilities
Lights for daytime	Airport with scheduled flights	• Runway Threshold Light • Precision Approach Path Indicator (PAPI)
Lights for nighttime	Airport with nighttime scheduled flight	• Runway Threshold Light • Precision Approach Path Indicator (PAPI) • Runway Edge Light • Runway End Light • Distance Marker • Stopway Light • Taxiway Edge Light • Aerodrome Beacon • Illuminated Wind Direction Indicator
Lights for Precision Approach	Airport with scheduled flights with Precision Approach Runway	• Runway Threshold Lights • Precision Approach Path Indicator (PAPI) • Runway Edge Light • Runway End Light • Distance Marker • Stopway Light • Taxiway Edge Light • Aerodrome Beacon • Illuminated Wind Direction Indicator • Precision Approach Lighting System (main approach) • Runway Touchdown Zone Light

3 Future Fleet Plan

The JCAB guideline is used to estimate the fleet requirement in 2020 as shown in the following formula:

$$RNFi = \sum (AAMi \times FT / AOT)$$

Where *RNF* : Requirement of fleet type *i*
AAMi : Annual aircraft movements of fleet type *i*
FT : Flight time
For Jet Aircraft: FT=(Route Distance (km)) x 0.00122+0.402
For Turboprop: FT=(Route Distance (km)) x 0.00194 +0.413
AOT : Annual operating hours of aircraft = 2,600 hours/aircraft (Jet)
1,600 hours/aircraft (Turboprop)

APPENDIX G
TRAINING PROGRAM

Field of Training	Organization	Level of Staff		Year of Plan					Total Cost USD
				1	2	3	4	5	
Air Transport Planning	MOT CAA VAC	1 Senior Transport Planner from each Organization (3) 1 month/ea	Trainee Man-Month	1 1	1 1	1 1			10,500
Air Transport Management	CAAV VAC	2 Senior Managers from each Org (4) 6 weeks/ea	Trainee Man-Month	1 1.5	1 1.5	1 1.5	1 1.5		21,000
Project Management	CAAV VATM MPI	2 Senior Managers from each Org (6) 2 months/ea	Trainee Man-Month	2 4	2 4	2 4			42,000
CNS Operational Management	VATM	2 Senior Engineers (2) 1 month/ea	Trainee Man-Month	1 1	1 1				7,000
CNS Technical Management	VATM	2 Senior Engineers (2) 1 month/ea	Trainee Man-Month		1 1	1 1			7,000
ATM Implementation Planning	VATM	2 Senior ATM Officers (2) 1 month/ea	Trainee Man-Month	1 1	1 1				7,000
ATM Operational Planning	VATM	2 Senior ATM Officers (2) 1 month/ea	Trainee Man-Month		1 1	1 1			7,000
Impact of CNS/ATM on MET Services	MET	2 Senior Managers (2) 1 month/ea	Trainee Man-Month		1 1	1 1			7,000
Civil/Military Coordination	CAAV VATM VNAF	2 Senior ATM Planners from each Org (6) 1 month/ea	Trainee Man-Month	3 3	3 3				21,000
Planning Oversight	MOT MPI CAAV	1 Senior Manager (3) 1 month/ea	Trainee Man-Month	1 1	1 1	1 1			10,500
Technical Standards	MOT CAAV VATM CATCV	1 Senior Manager from each Org (4) 2 weeks/ea	Trainee Man-Month		2 1		2 1		7,000
Safety Oversight	MOT CAAV	2 Senior Managers (4) 2 weeks/ea	Trainee Man-Month	2 1		2 1			7,000
MBA Business Studies	CAAV	2 Senior Managers (2) 2 years/ea	Trainee Man-Month	1 24			1 24		168,000
MA English Language	CATCV	2 Lang Instructors (2) 2 years/ea	Trainee Man-Month		1 24			1 24	168,000
Management of Training	CATCV	2 Managers (2) 2 months/ea	Trainee Man-Month		2 4				14,000
Environmental Standards	CAAV	2 Environmental Officers (2) 1 month/ea	Trainee Man-Month		1 1		1 1		7,000
Facilitation	Customs Immig CAAV Apt Auths	2 Officials each from Customs, Immig, CAAV 1 from each Apt Authy Study tour & Course (9) 1 month/ea	Trainee Man-Month		3 3	3 3	3 3		31,500
Aviation Security	CAAV VAC Apt Auths	2 Senior Security Staff each from CAAV, VNA, 1 from each Apt Authy. Study tour & Course (7) 1 month/ea	Trainee Man-Month		2 2	2 2	3 3		24,500
Satellite Technology Communications	VATM	2 Senior Engineers (2) 6 weeks/ea	Trainee Man-Month			1 1.5	1 1.5		10,500
Satellite Technology Navigation Data Communications	VATM VATM	2 Senior Engineers (2) 6 weeks/ea 2 Senior Engineers (2) 1 month/ea	Trainee Man-Month Trainee Man-Month			1 1.5 1 1	1 1.5		10,500 7,000
Automation	CAAV VATM	2 Senior Managers from each Org (4) 1 month/ea	Trainee Man-Month	2 2	2 2				14,000
Computer Networking	CAAV VATM	2 Senior Managers from each Org (4) 1 month/ea	Trainee Man-Month	2 2	2 2				14,000
Surveillance Techniques	VATM	2 Senior Engineers (2) 1 month/ea	Trainee Man-Month		2 2				7,000
Traffic Forecasting	CAAV VATM	2 Senior Managers from each Org (4) 1 month/ea	Trainee Man-Month	2 2	2 2				14,000
Operational & Quality Control of Databases	CAAV VATM	2 Senior Managers from each Org (4) 2 weeks/ea	Trainee Man-Month		2 1	2 1			7,000
CNS/ATM Transition	CAAV VATM	2 Senior Managers from each Org (4) 2 weeks/ea	Trainee Man-Month	2 1	2 1				7,000
Human Resource Planning	CAAV VATM	2 Senior Managers from each Org (4) 2 weeks/ea	Trainee Man-Month	2 1	2 1	2			7,000
Airport Management Technical	Apt Auths	1 Technical Manager from each Authority (3) 1 month/ea	Trainee Man-Month			1 1	1 1	1 1	10,500
Airport Management Operations	Apt Auths	1 Operations Manager from each Authority (3) 1 month/ea	Trainee Man-Month			1 1	1 1	1 1	10,500
Airport Planning	CAAV	1 Airport Planner (1) 2 months	Trainee Man-Month		1 2				7,000
Airport Architecture	CAAV	1 Airport Architect (1) 2 months	Trainee Man-Month				1 2		7,000
Total Man Month				53.5	59.5	24.5	36.5	26	
ESTIMATED TOTAL COST OF ABOVE TRAINING				187,250	208,250	85,750	127,750	91,000	700,000

APPENDIX H
COST ESTIMATES

Estimated Costs by Year for Air Navigation System (2000-2010)

Unit: Thousand US$

Year	Equipment	Cost
2000	Reconstruction of HCM ACC	20,000
	Replacement of 6 NDBs	200
	ILS & VOR/DME Nha Trang & DME Phan Thiet	1,500
	Upgrade COM System to cater for ATN	1,000
	Equipment replacement program	500
	Test Equipment Laboratory	400
	ATC Procedural Trainer (CATC)	200
	Flight Calibration Contract	100
2001	NDBs for new airports	300
	Replace Ckala-M with PSR/MSSR-Mode S	7,500
	Upgrade (or replace) 3 SSRs to Mode-S	6,000
	Tower Control Packages (3)	600
	AWOS (3)	300
	Upgrade COM System to cater for ATN (continued)	1,000
	Test Equipment	1,500
	Equipment replacement program	500
	Multimedia Language Laboratory (CATC)	100
	Flight Calibration Contract	100
2002	Multimode TXs & RXs at Remote Stations and major Airports	9,300
	HCM FPDPS	3,000
	MSSRs-Mode S (2)	4,000
	Equipment replacement program	1,000
	ATC Radar Simulator	2,300
	Flight Calibration Contract	100
2003	Tower Control Pkgs (2)	400
	AWOS (3)	300
	HF Data Link equipment	2,000
	Restructuring ATS-DS Circuits	1,000
	ILS (2) & VOR/DME (2) for 2 Class 1 Airports	3,000
	Equipment replacement program	1,000
	Flight Calibration Contract	100
2004	Tower Control Pkgs (2)	400
	AWOS (3)	300
	Restructure AFTN	1,500
	SAR Upgrade	1,000
	ATIS equipment - major airports	1,000
	Equipment replacement program	1,000
	Flight Calibration Contract	100

Year	Equipment	Cost
2005	Reconstruction of Hanoi ACC as an ATM Center	30,000
	Hanoi FPDPS	5,000
	Equipment replacement program	1,000
	Flight Calibration Contract	100
2006	Automation of AIS	2,000
	Install or Replace Voice Logging Recorders (15)	1,500
	Equipment replacement program	1,000
	Flight Calibration Contract	100
2007	Ground Augmentation Systems (2)	600
	Central Aeronautical MET facility improvements	1,500
	Equipment replacement program	1,000
	Training equipment for CATC	400
	Flight Calibration Contract	100
2008	Ground Augmentation Systems (2)	600
	Equipment for ADS-Broadcast	2,000
	Equipment replacement program	1,000
	Flight Calibration Contract	100
2009	Ground Augmentation Systems (2)	600
	Improve air nav facilities, 3 Class 3 Airports	1,500
	Equipment replacement program	1,000
	Flight Calibration Contract	100
2010	Ground Augmentation Systems (2)	600
	Improve air nav facilities, 3 Class 3 Airports	1,500
	Equipment replacement program	1,000
	Flight Calibration Contract	100
	ESTIMATED COST OF TOTAL PROGRAM	129,000