JAPAN INTERNATIONAL COOPERATION AGENCY

PRIME MINISTER'S OFFICE
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR REHABILITATION
OF
VIENTIANE INTERNATIONAL AIRPORT
IN
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

MARCH 1995

JAPAN AIRPORT CONSULTANTS, INC.
AZUSA SEKKEI CO.,LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY

PRIME MINISTER'S OFFICE
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR REHABILITATION
OF
VIENTIANE INTERNATIONAL AIRPORT
IN
THE LAO PEOPLE'S DEMOCRATIC REPUBLIC

MARCH 1995

JAPAN AIRPORT CONSULTANTS, INC.
AZUSA SEKKEI CO.,LTD.

Table of Contents

Ⅳ Present Condition of Vientiane International Airport

Ⅴ Contents of Project

PREFACE

In response to a request from the Government of Lao People's Democratic Republic, the Government of Japan decided to conduct a basic design study on the project for rehabilitation of Vientiane International Airport and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Laos a study team headed by Mr. Yukihiro Koizumi, second basic design study division, grant aid study & design department, JICA and constituted by members of Japan Airport Consultants, Inc. and Azusa Sekkei Co., Ltd. from October 3 to November 1, 1994.

The team held discussions with the officials concerned of the Government of Laos, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Laos in order to discuss a draft report, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Lao People's Democratic Republic for their close cooperation extended to the teams.

March 1995

Kimio Fujita
President
Japan International Cooperation Agency

Mr. Kimio Fujita,
President
Japan International Cooperation Agency
Tokyo, Japan

March, 1995

Letter of Transmittal

We are pleased to submit to you the basic design study report on the project for rehabilitation of Vientiane International Airport in the Lao People's Democratic Republic.

This study was conducted by Japan Airport Consultants, Inc. and Azusa Sekkei Co., Ltd., under a contract to JICA, during the period August 11, 1994 to March 31, 1995. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Laos and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, and the Ministry of Transport. We would also like to express our gratitude to the officials concerned of the Department of Civil Aviation, the Embassy of Japan in Laos for their cooperation.

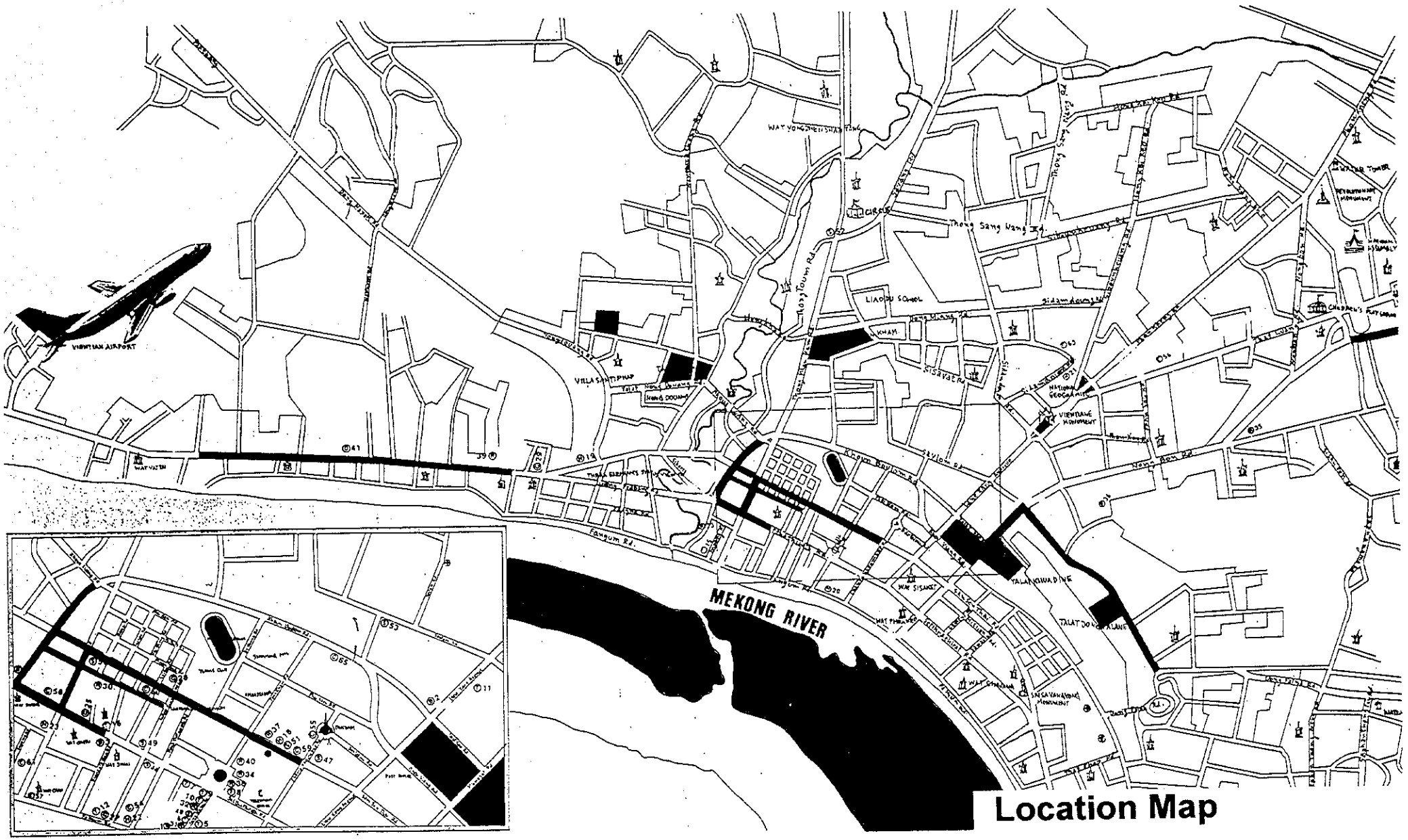
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

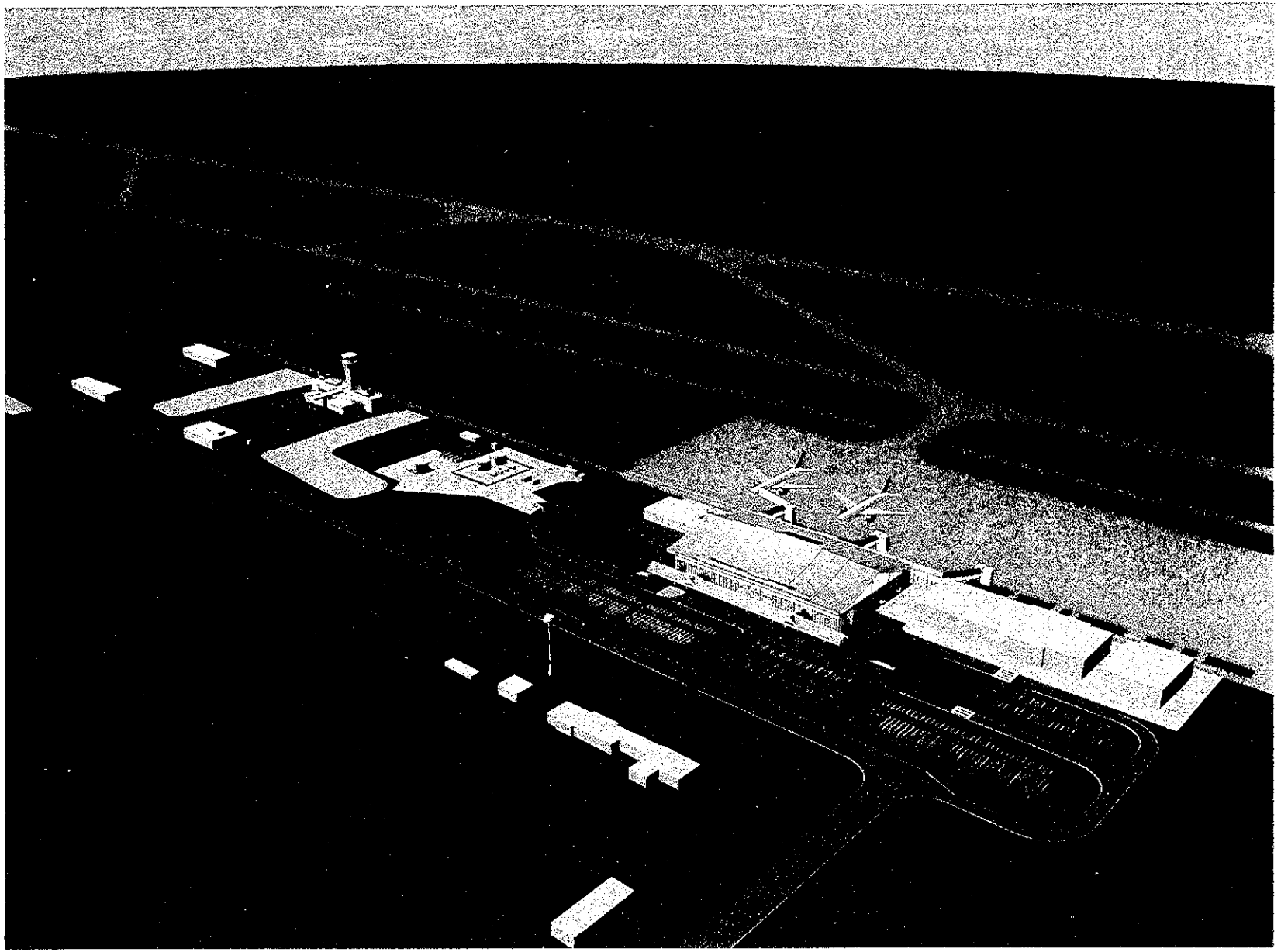
S. Shibata

Shigeru Shibata
Project Manager,
Basic design study team on
the project for rehabilitation of
Vientiane International Airport
Japan Airport Consultants, Inc.
Azusa Sekkei Co., Ltd.

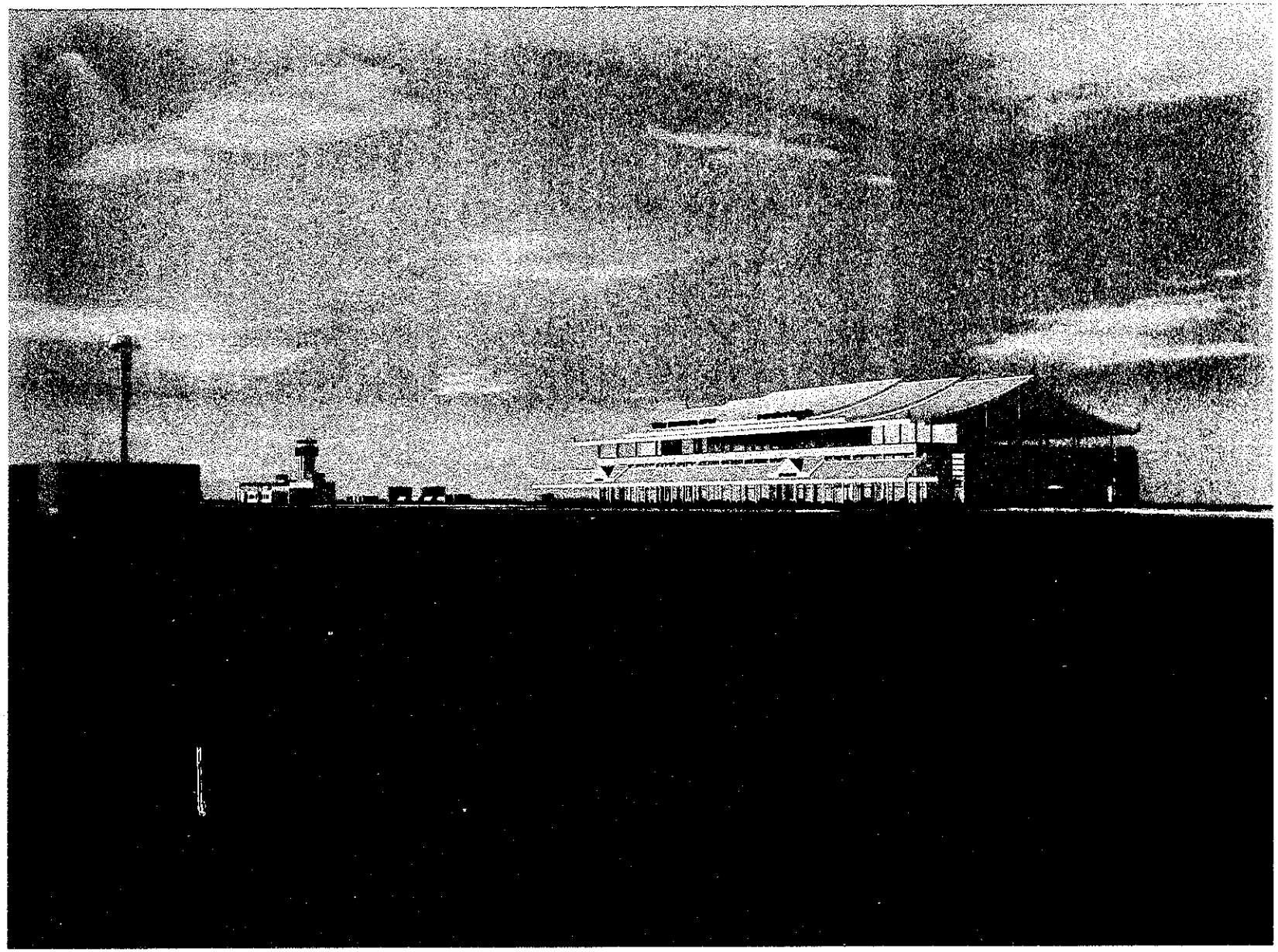
Lao PDR Country Map


VIENTIAN AIRPORT
WAT VOMONEESHAWTHING
Thong Sang Wang 34
LIAODU SCHOOL
KHAM
SISAVATH RD
VILLA SANTIPHAP
WAT VATH
Fa Ngum Rd.
MEKONG RIVER
WAT SISAKET
WAT PHRAKEO
VIENTIANE MONUMENT
NATIONAL GEOGRAPHIC
CHILDREN'S PLAY GROUND
Location Map

Perspective (Airside)



Bird's-eye View from Curbside



Perspective (Curbside)

Definitions and Abbreviations

In the present report the following terms are defined as hereby specified:

"Vientiane International Airport Development Plan"

The overall development plan, including improvements, renovation and rehabilitation, of the entire airport and related facilities of the object airport. The development plan is primarily based on the relevant parts of the "Draft Master Plan for Civil Aviation - Lao People's Republic" (CAMP) prepared by UNDP/ICAO in 1990, and subsequently reviewed and updated by ADB as documented in its 1993 report entitled "Lao Airports Improvement Project - Airport Development Plans." The development plan is implemented by multilateral international assistance under ADB's coordination.

"Project for Rehabilitation of Vientiane International Airport," or **"the Project"**

"Rehabilitation project" is defined to mean and comprise those parts of the above-defined Development Plan, for which Japan's grant assistance is provided and the present Basic Design Study is undertaken by JICA.

Glossary of Terms and Abbreviations

airfield facilities	Collective term meaning runways, taxiways and aprons of an airport.
terminal complex	Usually comprises passenger and cargo terminal buildings, administration building, control tower, landside road and drainage system, car park, and other ancillary facilities.
navaids	Either radio or visual aids to navigation.
UNDP	United Nations Development Programme
ICAO	International Civil Aviation Organization
ADB	Asian Development Bank
NDF	Nordic Development Fund
OPEC	Organization of Petroleum Exporting Countries
JICA	Japan International Cooperation Agency
DCA	Department of Civil Aviation
NAAL	National Airport Authority of Laos

MCTPC	Ministry of Communications, Transport, Posts and Construction
CWIU	Capital Works Implementation Unit, an organizational unit of Lao DCA, charged with implementation of airport development projects.
EDL	Electricité de Laos
AC	Alternating Current - Commercial power source
ACC	Area Control Center
AFL	Apron Flood Light
AFTN	Aeronautical Fixed Telecommunication Network
AIP	Aeronautical Information Publication - A publication issued by a State authority containing aeronautical information of a lasting nature essential to air navigation.
AIS	Aeronautical Information Service - A service dedicated to collecting, editing and disseminating aeronautical information compiled into AIP, NOTAM or aeronautical information circular.
ATC	Air Traffic Control - a service provided to promote air safety and ensure orderly flow of air traffic.
ATS	Air Traffic Services - consisting of air traffic control, flight information and alerting services.
BHS	Baggage Handling System
CAMP	Draft Master Plan for Civil Aviation - Lao People's Democratic Republic" by UNDP/ICAO
CBR	California Bearing Ratio
CIQ	Customs, Immigration and Quarantine
CVCF	Constant Voltage Constant Frequency equipment
DME	Distant Measuting Equipment
FIS	Flight Information Service - a service provided by a Flight Information Center (FIC) within a Flight Information Region (FIR) for the purpose of giving advice and information useful for the safe and efficient conduct of flights.

FIR	Flight Information Region - a defined airspace within which flight information service and alerting service are provided by the competent authority.
GC	Generator back-up Circuit
GL	Ground Level
GPS	Global Positioning System
GS	Glide Slope
GSE	Ground Support Equipment
HF	High Frequency
ILS	Instrument Landing System
IPT	International Passenger Terminal Building
JIS	Japan Industrial Standard
LLZ	Localizer
MDF	Main Distribution Frame
MJV	Major Vehicle
MM	Middle Marker
NDB	Non-Directional Beacon
OM	Outer Marker
PBB	Passenger Boarding Bridge
PBX	Private Branch Exchange
PC	Precast Concrete
POL	Petrolium, Oil and Lubricant - Aircraft fuel tank farm and supply facilities
PTB	Passenger Terminal Building
RIV	Rapid Intervention Vehicle
RX	Receiver
SALS	Simple Approach Lighting System
TX	Transmitter
VASIS	Visual Approach Slope Indicator System
VFR	Visual Flight Rules
VHF	Very High Frequency
VIA	Vientiane International Airport
VIP	Very Important Person
VOR	VHF Omni-directional Radio range

Summary and Recommendations

Lao People's Democratic Republic (Lao PDR) is a landlocked country located in the central part of the Indochina peninsula. It has a land area of approximately 236,000 km^2, and a population of about 4.57 million. Lao PDR is a multiracial nation, Lao constituting the largest ethnic group with some 50% of the total population.

The country was first unified under the Kingdom of Lane Xang in the 14th century, subsequently broke up into three kingdoms, eventually coming under the control mainly of Thailand, until it became part of French Indochina in the 1890s. Laos became an independent sovereign state in the middle of this century, and after a quarter of a century of civil unrest, the present Republic was established in 1975. The Lao PDR government initiated a planned economy, but not having achieved much, the government realigned its economic policy in mid '80s toward a free market economy.

Being a landlocked country, Lao PDR necessarily depends heavily on surface transport. There exists, however, no railway, and only a limited means of water transportation available along the Mekong River. Therefore, road plays an important role in the country's transport system, but its network still leaves much for improvement, with only 19% of all roads, or 50% of national roads, having been paved. Under the circumstances, air transport has become another major means of transport, but here again its infrastructure such as airports and air routes, as well as airlines, are all not sufficiently developed. Such inadequacy of overall transport infrastructure is obviously impeding the economic development of the country, and the national development plans of late are placing a preferred emphasis on investments in the transport sector, particularly in the development of roads and air transport infrastructure.

Just as the demand for development of adequate air transport infrastructure intensified along with the progress in opening up the national economy, the DCA (Department of Civil Aviation) completed in 1991 a 10-year Civil Aviation Master Plan (CAMP) under assistance from UNDP and ICAO. On the basis of the master plan, a conference of potential donors was called in 1992, on ADB's initiative, to discuss the possibilities of collaborative contribution, thus setting the implementation of the plan in motion. As regards the Vientiane

International Airport, Japan, France, ADB and NDF (Nordic Development Fund) agreed to cooperate in its development.

The Lao PDR government asked Japan for assistance in the development of terminal facilities as well as in the renewal and/or improvement of some specialized airport and air navigation equipment. The Japanese government agreed to provide the assistance as requested, and has undertaken the present basic design study.

The study was started on August 11, 1994, and the first site survey was conducted during August 17-30, the second site survey taking place from October 3 to November 1, 1994, the draft final report submitted and discussed between February 8 and 19, 1995, and the report was finalized in March 1995.

Vientiane International Airport is located at about 4 km west of Vientiane city on a flat plain along the Mekong River. The average elevation of the airport site is about 170 meters above sea level. As this happens to be below the HWL (high water level) of the Mekong, the airport was flooded several times in the past before the existing embankments were built. Being close to the capital city, the airport is supplied with commercial power and city water without difficulty, but sewerage is not sufficiently developed. Despite its close proximity to the urban area, the airport has not caused aircraft noise problems, due partly to its relatively low traffic density, and also because the flight paths are set over and along the Mekong River away from the city center. Vientiane International Airport was inaugurated in 1962, and except for the runway being extended in early 1970s to the present length of 3,000 meters under Japanese assistance, no other noteworthy improvements or renovations have been executed, leaving the facilities to deteriorate through aging, some beyond functional tolerance. Being the national capital gateway airport, VIA naturally serves as the center of both international and domestic air transport network of the country.

Airports in the Lao PDR used to be operated by the NAAL (National Airports Authority of Laos) until 1994, when the Authority was integrated into the DCA which then came under the Prime Minister's Office. With the nationwide total staff of 320, DCA in turn was charged with the entire administrative and operational responsibilities of all airports in Laos. DCA is also the agency

responsible for the development of airports, and the CWIU (Capital Works Implementation Unit), reporting to the DCA, is delegated power to carry out the actual implementation works.

The Airport's revenue is limited because the traffic demand is still small and also because of the insufficient capacity and inadequate service level of the existing facilities. The number of aircraft flying over Laos, however, is quite large, and the overflight charges occupy the majority of the aviation-related income.

In 1993 the Vientiane International Airport recorded 90,000 international and 150,000 domestic passengers. The volumes are not large, but the steady growth tendency, that started in late '80s and marked a sharp increase in 1989 to an average of over 20% per annum, is apparently attributable to the economic open-door policy implemented in mid '80s. This well-founded, accelerating growth tendency adds an element of capacity to the already urgent need for the rehabilitation of outdated air transport infrastructure.

The basic design made under the present study is based on the updating review of the above-mentioned Civil Aviation Master Plan and ADB's Airport Development Plans. It is the product of planning philosophy to make most of the existing facilities and local resources, to meet the minimum yet sufficient requirements of the design year 2005, to make provisions for future expansion flexibility, and to see to it that the improved facilities are sufficiently maintainable with the technical and human resources available in Laos.

Since the present rehabilitation project requires that it be implemented without interrupting the normal airport operation, the first priority is given to ensuring uninterrupted functioning of the control tower and operations building facilities. To this end, and also to streamline the construction schedule, the project is planned for a two-phased construction. The first phase includes construction of the new control tower and operations building and the new fire station at respective new sites to make way for siting of the new international passenger terminal building. The first phase construction shall also include all necessary facilities such as of roads, water supply, power supply, sewerage, etc. incidental to the relocation of these two buildings, as well as any and all equipment that require urgent rehabilitation or renewal. The second phase construction shall

start after the existing functions will have been transferred to the new buildings, and shall include construction of the new international passenger terminal and all other buildings and related terminal facilities and equipment within the scope of the present project. The contents of the two phases are outlined in Table 1 .

Table 1 Contents of Phased Construction

[First Phase]

Facility	Outline	Demand
Control Tower and Operations Building	RC Structure/6 stories approx. 1780 m^2	Established with EQ layout and staff numbers
Fire Station	RC Structure/1 story approx. 700 m^2	ICAO classification "7"
Powerhouse	RC Structure/1 story approx. 640 m^2 22KV Dual line input Generator 500KVAx3 (one is stand-by)	EQ Requirement 1940 KVA
Utilities and Civil Works	Site Preparation, Roads, Stormwater Drainage, Water Supply Facilities (Storage tank 50 m^3/Elevated Tank 50 m^3/ Gravity distribution system), A part of water and power supply piping and cabling	Daily water consumption approx. 100kl Daily sewage volume 58 m^3
ATC/ Communication Equipment	ATC control console, Air-Ground communication, intercom, radio nav-aids, VHF communication, Transceiver, ACC console, AFTN	Replacement of existing facilities
Fire Fighting Equipment	RIVx1, MJVx1, Ambulancex1	ICAO classification "7"

[Second Phase]

Facility	Outline	Demand
International Passenger Terminal Building	RC Structure/3 stories approx. 11930 m^2	Peak hour dep./arr. passengers/410 pax.
Utilities and Civil Works	Site Preparation for 2nd Phase, Stormwater Drainage, Car Park (Private car x 250, Taxi x 45, Bus x 5, Gravel pavement) Roads (Access/4 lanes/14.5m width, circulation/2 lanes/7m width, Gravel pavement) A part of water and power supply piping and cabling, Sewage Treatment Facilities in Terminal	Inflow/outflow distribution At least double lanes are secured for accidents and rehabilitation
Airport Maintenance Workshop	RC Structure/1 story approx. 630 m^2	10 staff/accommodation of equipment
Radio Nav-Aids	ILS set	Precision Approach Category I
Airport Maintenance Equipment	Tructorx1, Suction sweeperx1, Backhoex1, Lawnmowerx1, Whipper-Snipperx5, Sealing machinex1, Paint markerx1, Concrete cutter sawx1, Bituminous heaterx1, Tip truckx1, 4 wheel driven car x 1	Minimum airport maintenance

The VIA Rehabilitation Project which is the object of the present study, and other improvements to be made by other donors on VIA, coupled with the development of major domestic airports and air navigation facilities being implemented more or less in parallel, will together undoubtedly enhance the safety and service level of air transport in Laos, and also contribute to further increasing the country's air transport demand, as the nationwide development plan should eliminate the known growth-impeding factors. Such increase in air traffic can in turn be expected to induce economic repercussion effects such as of increased business and employment opportunities and tourism income, not to speak of the likely direct benefits of increased airport tariff revenue. These direct and indirect benefits are expected not only in Vientiane but also in other parts of Laos. Despite all such bright outlook, however, because the air transport demand is still too small to enjoy a scale merit, it is rather hard to expect that the Project will yield sufficient net income to make loan repayments feasible within a significant period of time. Consequently, funding of the Project under a grant aid program is considered fit.

In order to enhance the desirable effects of the Project, training of the airport personnel as scheduled by UNDP is not only worthwhile but indispensable. It is also highly recommendable to make Lao airlines, particularly the Lao Aviation, competitive against airlines of the neighboring countries. As it stands now, the Lao government is forced to reject applications of foreign airlines to introduce or increase service to VIA for the sake of protecting the still uncompetitive Lao Aviation. Efforts should be made to create a situation where Lao Aviation takes the initiative in increasing flight activities and exploring passenger demand, while allowing foreign airlines to follow suit. It is also recommended that specialized maintenance training be given to airport personnel concerned by qualified experts for a certain period of time, in order to prevent reversing back to the old custom of providing little or no systematized maintenance, thus paving the way for making VIA a viable airport.

I Overview of Request for Assistance

1-1 Background of Request

Vientiane International Airport serves the national capital and is a center of air transport in Lao PDR. Since there is no railway in Laos, the country's surface transport has to depend on the insufficiently developed road system and the limited river transport. Air transport, therefore, plays an important role in the transport system of the landlocked country.

The airport was opened in 1962, more than three decades ago. Between 1969 and 1972 its runway and taxiways were extended under Japanese grant aid program. Since then, except for some equipment replacement and staff training provided by UNDP/ICAO, no notable improvements or repairs have been made on airport facilities, which consequently now suffer from deteriorated pavements, aged facilities, insufficient capacity, etc. Such problems are not limited to VIA only, but more or less similar problems are seen in other major domestic airports of Luang Prabang, Savannakhet and Pakse. Besides airports, other aviation-related infrastructures of aeronautical communications and radio navigation aids that are indispensable for safe flight operation are also badly in need of radical renovation, since many equipment are broken, out of service or malfunctioning.

To address the problem, the Lao PDR government, with the assistance of UNDP/ICAO, completed in 1991 a Civil Aviation Master Plan (CAMP) and a feasibility study covering the development of Vientiane International Airport, three major domestic airports, air navigation, communications and other necessary facilities of aviation infrastructure.

On the basis of the Master Plan, a conference of potential donors was called by the Asian Development Bank (ADB) in 1992. Japan participated in the conference and expressed interest in contributing for facility development. ADB subsequently conducted a review of the Master Plan, and in November 1993 decided to provide a US$1.5 million

loan for the nationwide airport development plan.
Following up these moves, the Lao PDR government officially requested the aid institutions and the countries including Japan to provide technical and financial assistance for the implementation of the development plan. Japanese government granted the request, and decided to undertake the present basic design study for the rehabilitation of Vientiane International Airport.

1-2 Major Components of Request

The VIA development plan aims to improve thoroughly the entire airport facilities by rehabilitating the disabled functions and supplementing the necessary capabilities both in quantity and in quality to cope with the rapidly evolving air transport demand. Itemized below are the major components of the development plan, which is to be implemented with the coordinated assistance of ADB, Japan, France and NDF (Nordic Development Fund).

- Improvement of runway, taxiways and apron pavements;
- Improvement and expansion of roads and car parks;
- Improvement, relocation and new construction of terminal facilities;
- Expansion and improvement of utility facilities;
- Renewal of ATS, air navigation and communication facilities;
- Improvement and renewal of airport lighting and meteorological facilities; and
- Renewal of fire fighting vehicles and airport maintenance equipment

Of the above components, those Japan has been requested to provide assistance for include:

- Improvement and expansion of roads and car parks;
- Construction of new international passenger terminal building;
- Construction of new control tower and operations building;
- Construction of new fire station;
- Construction of new powerhouse;
- Construction of new airport maintenance workshop;
- Improvement and renewal of water supply, power supply and sewage treatment facilities;
- Renewal of air traffic control and aeronautical communications facilities; and
- Provision of fire fighting vehicles and airport maintenance equipment

In addition to the above, provision of ILS (Instrument Landing System) and air route and airport surveillance radars to cover the entire country

was officially requested by the Lao PDR government after the study team's return from the second site survey. While both these equipment enhance the safety and efficiency of flight operations, and in this sense can be regarded as suitable objects of grant aid, the latter by nature involves nationwide technical and siting survey which grossly exceeds the scope of the present project which solely concerns VIA. As a consequence, only ILS has been accepted for addition to the original list. The facilities included in the finalized list as objects of Japanese grant aid are defined in the present study as the contents of the "Vientiane International Airport Rehabilitation Project."

1-3 Project Implementing Agency

The DCA (Department of Civil Aviation) is the implementing agency of the Vientiane International Airport development plan, of which the VIA Rehabilitation Project is a part. The DCA, formerly under the MCTPC (Ministry of Communications, Transport, Posts and Construction), came under the Prime Minister's Office in 1994 and absorbed the former NAAL (National Airports Authority of Laos) which used to operate all airports of the country. For the actual execution of the development works, CWIU (Capital Works Implementation Unit) is delegated the necessary power by the DCA.

The Unit is staffed by concurrently assigned directors and assistant directors of the DCA divisions, but functions independent of those divisions.

II Outline of Study

Having accepted the Lao PDR government's request for assistance, the Japanese government asked JICA (Japan International Cooperation Agency) to conduct the present basic design study for the Vientiane International Airport Rehabilitation Project. JICA executed the study in six parts, starting with the first site survey, followed up by the conceptual planning stage, the second site survey, the basic design stage, the draft final report presentation, and the finalization of the study report.

The first site survey was conducted for 14 days from August 17 to August 30, 1994 by the study team headed by Mr. Michio Kanda, assistant director of Grant Aid Project Management Department of JICA. At the beginning of the first site survey an inception report containing the contents, methodology and study schedule was submitted to the Lao counterparts for subsequent discussion focusing on the scope and contents of the study. Since the overall development plan of Vientiane International Airport comprises a wide variety of works ranging from airfield facility rehabilitation to terminal area development and equipment renewal, and also involves many assisting entities, it was imperative to first establish a clear demarcation of each donor's scope of work, and then to identify the work sequence and actual status of work progress. Having finalized the demarcation plan with the consent of all concerned, the study team conducted the inventory of existing facilities, and examined the adequacy of the contents of the development plan through a close review of the CAMP and the ADB's review report.

During the conceptual planning stage, the study team worked out the terminal area layout plan and conceptual plans of the facilities under Japanese grant aid, on the basis of the findings of the first site survey. Results of the conceptual planning stage work were documented in the form of an interim report.

The second site survey was conducted for a 30-day period from October 3 to November 1, 1994 by the study team headed by Mr. Yukihiro Koizumi, Second Basic Design Section staff, Grant Aid Project Study Department of JICA. During this survey, following points were mainly discussed based on

the interim report:

- Reconfirmation of the earlier established demarcation plan;
- Identification of the present status of implementing organization;
- Terminal area layout plan;
- Conceptual plan of facilities under Japanese grant aid; and
- Airport operation and maintenance system plan

The field survey made during the second site survey period included the following items:

- Detailed survey of current condition of the existing facilities;
- Topographical and geological survey of the terminal area; and
- Survey of construction equipment and materials availability

During the basic design stage, basic design of the terminal area facilities was made based on the previously agreed conceptual plan of each facility. Then calculation was made of the construction cost to form the basis of the project cost estimation. The calculation was based on the basic design drawings and specifications. This was followed by a planning study to ensure due completion of the project, as well as preparation of the operational, maintenance and staff training programs for the renovated VIA, this aimed at ensuring the viability of the facilities long after the rehabilitation project will have been completed. The results of all these works were compiled into a draft final report.

The draft final report was delivered and presented to Lao PDR government on February 9, 1995, and its contents, including the addition of ILS, but not radars, in the project scope, were thoroughly discussed during the ensuing 10 days, before the draft was generally approved for subsequent finalization as the Basic Design Study for the Rehabilitation of the Vientiane International Airport by March 1995.

Name list of the study team members and of the Lao counterparts, study schedule and minutes of discussions held during the course of the present study are shown in Appendices.

III Background of the Project

3-1 Socio-Economic Situations in Lao PDR

3-1-1 Social and Economic Situation

The recent social and economic situations in Lao PDR are briefly outlined in Attachment 5 to the present report.

3-1-2 Financial Situations

The principal industry of the Lao PDR is agriculture, which accounts for the majority of the gross domestic products. In recent years, however, the share of agriculture in the GDP has shown a tendency to decrease, while the shares of manufacturing and service industries are increasing. In the manufacturing sector, wood products and hydropower generation, that utilize the abundant natural forest and water resources, used to be the major elements, but in the wake of the open-door policy, production of construction materials, beverages, tobacco and other luxury items has increased at a significant rate. Nevertheless, these emerging industries are much too small in scale, and the national economy is expected to continue its dependence on the traditional primary industry of agriculture for some time to come. The balance of public finance of Lao PDR has shown a constant deficit in considerable proportions to the GDP.

By the same token, the inherent deficits in terms of the balance of trade cannot be expected to improve in the foreseeable future as long as the wood products and electric power remain the major export items. The balance of payments of Lao PDR, therefore, is barely maintained its balance on the premise of huge foreign assistance being extended.

3-2. Airport and Aviation Development Plans

3-2-1 National Plan

Following the Second 5-Year Plan, the Lao Government established the Third 5-Year Development Plan for the period of 1991-1995 inclusive, and is presently exerting efforts for the national development according to the basic policy laid down in the current 5-Year Plan that includes the Public Investment Program (PIP). The basic policy consists of the following three items:

1) To satisfy fundamental needs of the nation such as food, housing, hygiene and education.
2) To pursue economic growth while maintaining economic stability.
3) To promote and maintain omnidirectional friendly international relations.

The Public Investment Program that complements the 5-Year Development Plan places emphasis on the development of social infrastructures of transport, power and communication systems. The three primary sectors together occupy 60% of the total investment, with transport occupying nearly 40%.

In the air transport sector, the following projects are planned for implementation:

1) To complete development of airport civil engineering works including runway repair and rehabilitation.
2) To modernize air traffic control and aeronautical communication systems to serve aircraft that arrive at and depart from the airports in Laos, as well as those that fly over the country.
3) To train personnel to qualify for ATC service, as well as to operate the modern equipment to be introduced.

The transport-related development policies include:

1) To promote completion of the transport system as a nuclear element in the expansion of communications and market integration.
2) To give top priority in public investment to the development of transport system, along with that of telephone and power supply system.
3) To improve maintenance and management system of the existing transport infrastructure.
4) To develop international air routes that will effectively contribute to the development of trade and tourism.

To realize the above policies, the Government has the strategy to develop the Vientiane International Airport as the center of national air transport services, and for this purpose has established the following three action plans:

1) To improve and expand the air traffic control system facilities at Vientiane so as to be able to provide adequate ATC service.
2) To increase air routes and engage in negotiations to obtain landing rights.
3) To develop Vientiane as a center of regional international air transport, and to expand international services of the national flag carrier in order to promote tourism.

As for the airport and air navigation system development, the UNDP/ICAO-prepared Draft Master Plan of Civil Aviation (CAMP) of 1991 contains the plans in respect of the 14 airports in Laos aimed at improving and upgrading the country's air transport infrastructure by the year 2000. The plan comprises improvement of runways and air navigation aids, improvement of communication system with remote airports, improvement of meteorological service at domestic airports, improvement of airport administration facilities and training of the aviation-related personnel.

Based on the CAMP, the Asian Development Bank conducted a feasibility study with a view to providing financing for the plan, and prepared a Review Report in 1993. The present development plan of the Vientiane International Airport is primarily based on the findings of the ADB Review Report.

3-2-2 Vientiane International Airport Development Plan

As stated above, the present development plan of the Vientiane International Airport originates from the UNDP/ICAO's Civil Aviation Master Plan and the review thereof made by the ADB. With the exception of the runway, taxiway, apron and several other facilities developed in the early '70s, the majority of the Airport's facilities and equipment in general are aged and obsolete and in some cases are totally out of function, as they have been left unattended ever since they were constructed in 1962. The present plan aims to rehabilitate the entire facilities and equipment of the Airport to the original condition and also to make the Airport serviceable well beyond the year 2000.

The objects of development items contained in the Master Plan and updated the ADB's review encompass the entire airport facilities as shown below.

- Improvement of runway, taxiway and apron pavements
- Improvement of stormwater drainage
- Improvement and expansion of road and car park
- Improvement of peripheral road and fencing
- Improvement of international/domestic passenger terminals
- Construction of new control tower
- Construction of new fire station
- Construction of new airport maintenance workshop
- Construction of new power substation
- Improvement and expansion of airport utility facilities
- Renewal of ATC system equipment
- Renewal of communication system equipment
- Installation of new VOR/DME and NDB

- Renewal of airport lighting system
- Renewal of meteorological facilities
- Renewal of airport maintenance equipment
- Renewal of rescue and fire fighting equipment

The present plan envisages to have the above development items covered by assistance from a number of countries and international institutions, and to complete the development by 2000 when the modernization and expansion of the nationwide air transport infrastructure including improvement of the domestic airports are targeted for completion.

3-3 Assistance Program of Other Countries and International Institutions

Besides Japan, France and Thailand are offering assistance in the nationwide airports and aviation development plan along with the 4 international institutions of ADB, UNDP, OPEC and NDF (Nordic Development Fund). Assistance being offered by each donor is summarized in Table 3-1.

As shown in the table, as far as the assistance for the rehabilitation of the Vientiane International Airport is concerned, Japan is responsible for the terminal facilities; France for the radio navaids; ADB for the airfield and terminal facilities, as well as for the overall project coordination; and NDF for the airport lighting and meteorological facilities.

Those parts of the Vientiane International Airport, for the rehabilitation of which Japan is offering grant assistance, are referred to in the present report as the Project for Rehabilitation of Vientiane International Airport, or simply as the Project.

Table 3-1 By-Donor Program of Assistance Provided for Lao Aviation Development

Donor	Current Status	Budget	Assistance Provided
Japan	Under basic design (Grant assistance)	—	Vientiane Int'l Airport - New int'l pax terminal, control tower/operations bldg. (relocated) - Renew ATC & radio communications equipment - Renew rescue and fire-fighting equipment - Others
France	St-1 Completed St-2 Completed St-3 To be completed April '95 (Grant assistance)	11.3 MFF 12.0 MFF 13.5 MFF	- New en-route VHF communications equipment - Renew VOR/DME (Vientiane/Pakse) - Renew NDB - New solar power units
Thailand	Work started February '94 (Grant assistance)	US$2M	Luang Prabang Airport - New passenger terminal and control tower - Improve apron, stormwater drainage and fencing - Improve pavements
ADB	Loan agreement signed February '94 Loan effective on 18 June, '94	US$15M	Vientiane Int'l Airport - Improve airfield facilities - Improve existing passenger terminal Luang Prabang, Savannakhet and Pakse Airports - Improve terminal facilities
UNDP	Pending UNDP HQ approval	US$0.5M	- Staff training
OPEC	Loan agreement signed January '95	US$8M	Savannakhet, Pakse and 10 minor dom. airports - Improve airfield facilities Savannakhet and Pakse Airports - Improve building
NDF	Loan agreement signed April '94	US$6.3M	Vientiane, Luang Prabang, Savannakhet and Pakse Airports - Improve/renew airport lighting system - Improve/renew meteorological facilities

3-4 History of Japan's Assistance

Upon establishment of the People's Democratic Republic, the Lao Government had enforced a planned economy up until 1986, when the "New Economic Mechanism" was introduced and the "open-door" policy has since been promoted. Along with the shifting of the national economic system into the market economy, the Government has sought assistance from free-market countries including Japan, and the Japanese government has agreed to support the economic reform efforts of Laos.

Japan has to date rendered both grant aids and technical assistance to Laos for the development of socio-economic infrastructure which is regarded as indispensable for Laos in order to achieve its economic self-reliance and independence. In 1974 Japan provided loan assistance for the Nam Ngum Dam construction, which is proving a substantial earner of the foreign currency through exports of the generated electric power to Thailand. No further loan assistance has since been provided, but on the other hand, provision of grant aids has continued since 1969. Projects implemented by such grant aids include Vientiane International Airport runway extension, city water supply system rehabilitation, elevated water tank construction, power substation rehabilitation, river port improvement, food production increase program, debt relief, educational equipment supply, educational and medical institution development, etc. The cumulative total of the grant assistance provided by Japan up to 1993 amounted to over 34 billion Yen.

3-5 Project Site Conditions

3-5-1 Natural Conditions

The project site of Vientiane belongs to the region of tropical monsoon climate, with the rainy season lasting from May to September, and the dry season from October to April. Mean monthly high temperature is over 30℃, and the humidity remains high throughout the year, averaging around 75%. It is hot and humid during the rainy season, but between October and January of the dry season it is relatively cool and dry. Mean low temperature in December is around 12℃. February to April are the hottest months, highest temperature often registering over 40℃. Annual precipitation in Laos differs largely by region, ranging from 1300mm to 3000mm. In Vientiane, annual mean is 1600mm, and between May and September of the rainy season monthly precipitation ranges from 250mm to 300mm.

Vientiane International Airport is situated approximately 4km to the west of the city center. The city lies within the Vientiane Plain having little or no undulation. The elevation of the existing airport terminal area, which is to be developed under the present Project, ranges 168m - 169m, with no significant undulation. However, there exist numerous ponds and swamps within the project site area, requiring site leveling works in some places.

The ground level of the airport site being lower than the flood water level of the Mekong River, the Airport was flooded three times in the past: in 1966, 1970 and in 1971. However, after the embankment was completed recently, no flooding has been reported. In this area, which is on the north side of the river, rain water generally flows to the north into the lower wetland, where it stays until the water level rises high enough to flow out turning toward the east, and ultimately flows into the Nam Pak Sak River. As the water level of the Mekong River rises higher, natural drainage in the inner land area worsens, and when the river rises even higher, the water back-flows into its tributary, badly flooding the lower parts of the inner land. The Airport's natural

drainage is similarly vulnerable and suffers from high water content in low-elevation areas.

The Airport lies on the dry riverbed of the Mekong River, with the top soil layer consisting of soft alluvial clay. In the terminal area, beneath the soft top layer lies a sand-gravel layer believed to be the diluvial deposits at the depth of approximately 12m and below from the ground level. Therefore, most of the buildings, except for the light-weight, steel-framed single-level buildings, will require 10 to 15m-long pile foundation. Outside structures built on soft surface layer will also require foundation soil improvement by such methods as displacement. Water table level is high at 1 meter from the ground level. It is, therefore, desirable to keep excavation work to a minimum depth, and to provide protectional measures of cut-off or pumping as necessary.

3-5-2 Social Infrastructure

(1) City Water

City water is supplied to each facility of the existing terminal area through a 75 ϕ water pipe branching off the 450 ϕ water main laid along the Vientiane-Luang Prabang road. The water was previously pumped up to an elevated water tank for gravity distribution, but now it is distributed directly from the city water supply. In order to supply water to the newly developed terminal area, the existing water supply system and its capacity need to be totally re-designed. Lao Water Supply has assured that a feeder water piping of up to 150 ϕ can be accommodated.

(2) Sewerage

There is no existing public sewerage system. Sewage is treated in septic tanks and then led to seepage pits, or discharged through nearby stormwater side ditch.

(3) Stormwater Drainage

The Airport being sited in a flat plain, and because the drainage canal system of the area is generally under-developed, drainage of the Airport is poor. The airfield stormwater runs through the drain ditch along the apron and the parallel taxiway into an unlined gutter and ponds, then runs through the north drain into the swamps and ponds. Beyond there exact water paths are not quite clear, but it obviously runs through the paddy fields in the north of Vientiane, and ultimately into the Mekong River tributary. In the terminal area, part of the stormwater runs through the drain along the side of the terminal building into the apron drainage system, while the rest flows through ponds or unlined gutter on the west side into the parallel taxiway drainage system. Earth and fallen-leaf deposits are seen accumulating on the bottom of the drain, impairing the already insufficient drainage capacity.

(4) Power Supply

Two outdoor cubicle-type transformers (22kW, 250KVA, 50Hz - 3 ϕ 4W) are installed to function as receiving station and substation. One serves the buildings, and the other is exclusively for air navigation facilities. Standby generator is installed in front of the powerhouse. The Lao DCA plans to add two more independent power receiving and distribution systems in order to enhance the reliability of electrical system. To accommodate the total power requirements of the entire terminal facilities, both existing and new, an overall review of the power supply system plan is necessary. According to the Electricité de Laos (EDL) provision of two additional independent systems with an increased total capacity is feasible.

(5) Telephone Line

According to the Department of Civil Aviation, five and two telephone lines are provided respectively to the international terminal and the control tower. Municipal telephone network is presently being developed in Vientiane, and no particular problem is anticipated in making increasing number of telephone lines available for the Airport in the future.

3-6 Environment

The present rehabilitation/improvement project concerns the entire airport facilities, but it does not extend beyond the existing airport site. Though an additional land space is required for the planned new terminal area, the necessary site is secured within the existing airport compounds, requiring no land acquisition. Since the existing facilities are not regarded environmentally hazardous, the improved facilities are likewise expected to be benign, barring, of course, the possibility of an unexpected urban encroachment in the Airport's vicinity in the near future.

IV Present Condition of Vientiane International Airport

4-1 Outline of Existing Aviation Systems

4-1-1 Vientiane International Airport

Vientiane International Airport was constructed in 1962 with a 2000-meter runway, which was extended by Japanese grant aid in 1970 to the northwest direction by 1000m to the present length of 3000m. The extension accompanied development of the rapid exit taxiway, establishing the basic framework of an international airport. The Airport, however, now suffers from overall aging of facilities, many beyond tolerance, as well as from prohibiting terminal capacity shortage, and many other inadequacies in terms of the quality of service by international standard.

Today the Airport is served by five international airlines including the national flag carrier of Lao Aviation. These airlines presently operate scheduled international services to and from Thailand, Cambodia, Vietnam, China and Russia. In 1993 the Airport recorded approximately 90,000 international and 150,000 domestic air passengers. The volumes may be relatively small, but they represent a remarkably accelerating annual growth tendency since 1989 when the so-called open-door policy came into effect in Laos. This makes the huge demand-capacity gap even greater and increasingly harder to cope with.

4-1-2 National Airport and Aviation System

There are a total of 14 airports with scheduled services existing in the country, of which is the only airport that serves international traffic. Luang Prabang, Savannakhet and Pakse airports serve as the three major domestic airports, the remaining 10 being categorized as minor domestic airports. As shown in Fig. 4-1, national airport system network of Laos is centered around Vientiane International airport as the

principal hub, with three major domestic airports functioning as sub-hubs, providing connections for and between one another of the 10 minor domestic airports. All 14 airports are now operated by the DCA that report to the Prime Minister's Office,

Since Laos is a land-locked country where the land transport system is relatively less developed, the national aviation network is likely to maintain its importance as an indispensable means of transport for the people of Laos. By the same token, aviation plays an important role in cargo transport as well. However, because of its inherent short-comings of relative high cost and load limitations, it cannot be expected to replace water transport as the principal means of cargo transport in Laos.

Lao Aviation, the national flag carrier, has its international and domestic operations as two separate organizations independent of each other, though both are based in Vientiane International Airport. Neither is yet to be organized to function as the corporate headquarters, nor is it equipped with own operation center. Both depend on foreign companies for aircraft maintenance, except for simple, minor work.
The international division at present operates only one B737 on a wet lease, while the domestic division operates many small aircraft such as ATR42 and Y-7. At present, the Vientiane International Airport is not functioning as the base airport of the national flag carrier, but this situation will change as the traffic grows at an accelerating speed in the years to come.

International air routes are established from Vientiane to Moscow, Kunming, Hanoi, Bangkok, Phnom Penh and Ho Chi Minh.

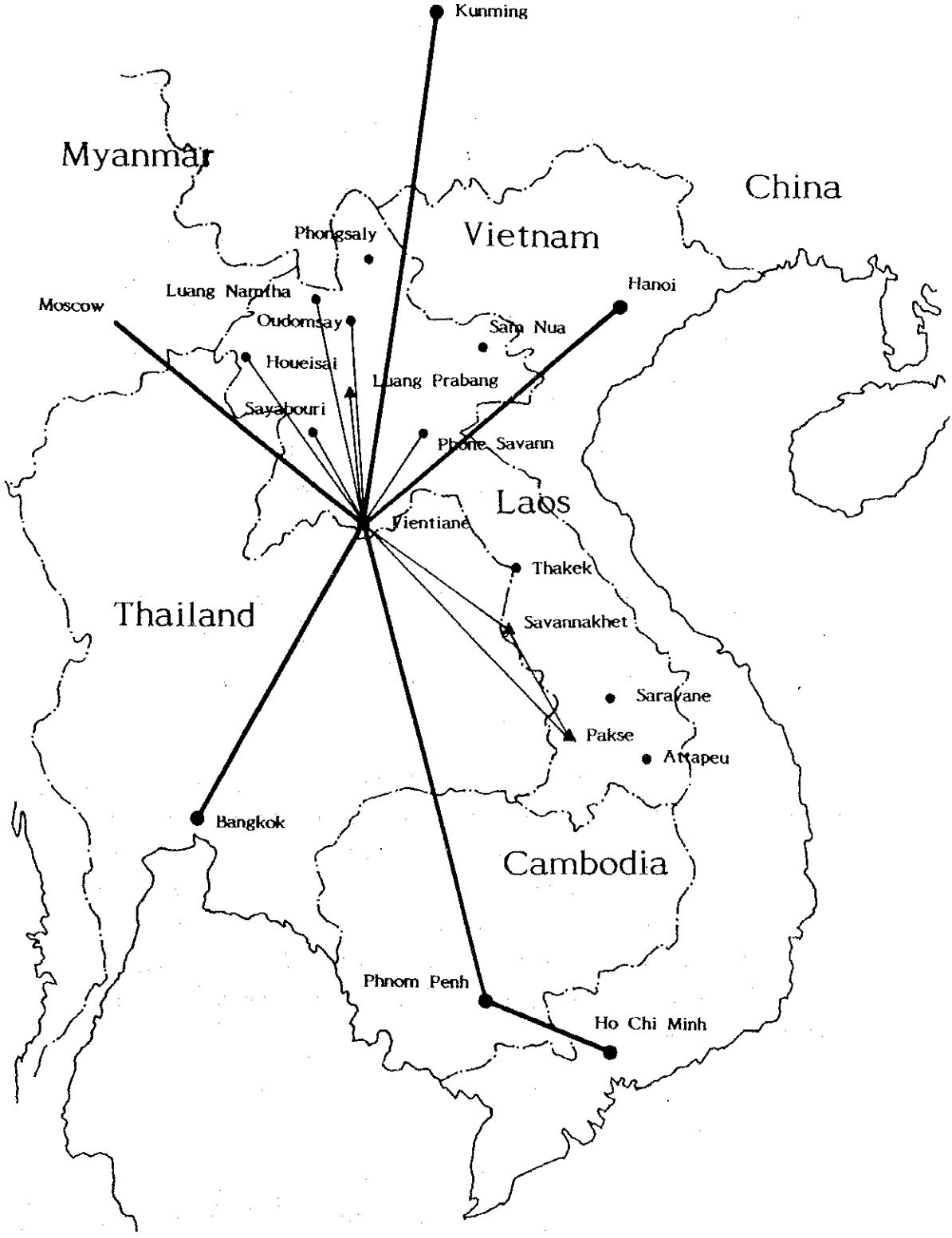


Fig. 4-1 National Airport System Network

4-1-3 Airport Operation/Administration System

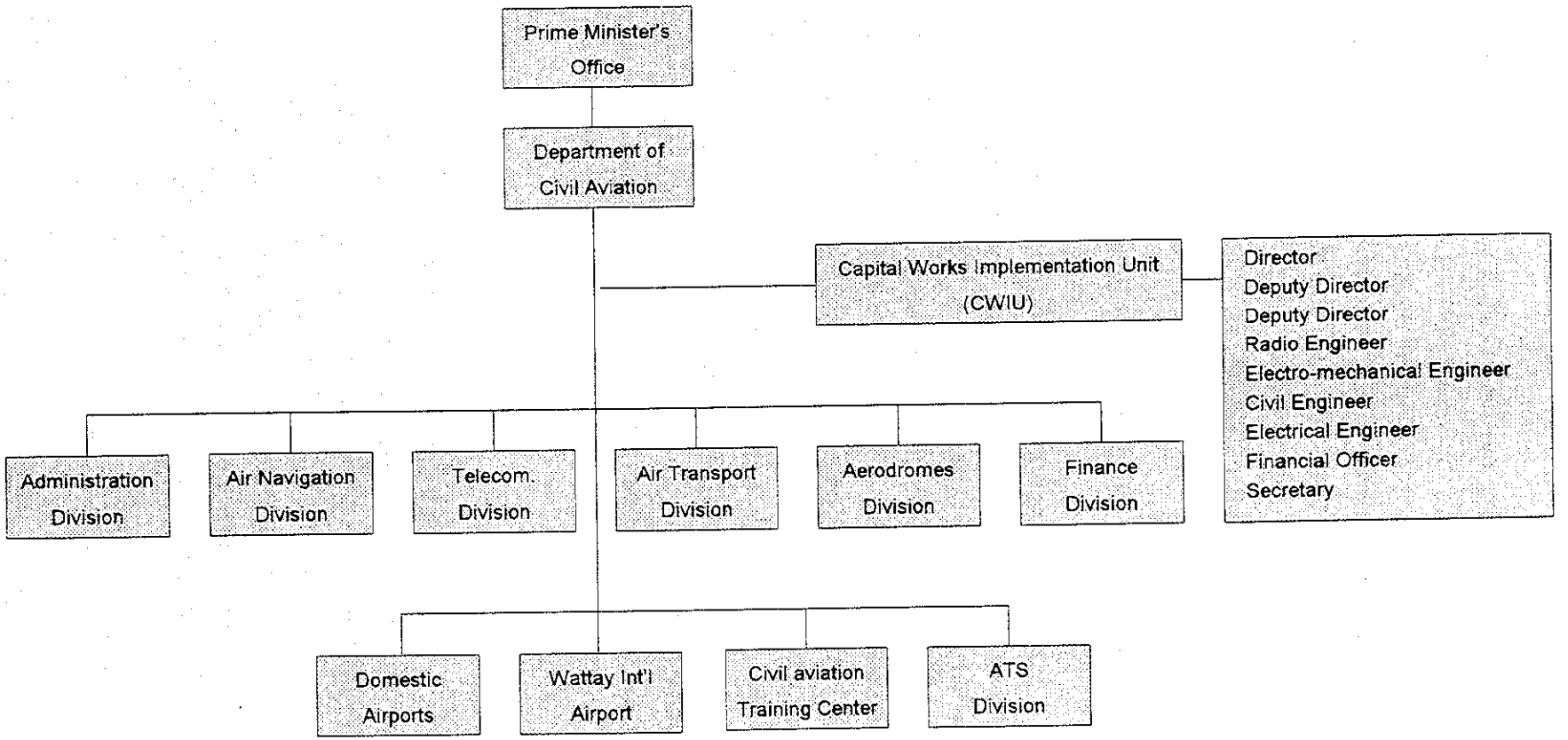
Up till 1994, airports in Laos were administrated and managed by the National Airports Authority of Laos (NAAL), while the DCA, then belonging to the Ministry of Communications, Transport, Posts and Construction, was responsible only for flight operations. Since the autumn of 1994, the DCA has come directly under the Prime Minister's Office and at the same time has integrated the former NAAL into the new DCA, both functionally and organizationally. The reorganized DCA has since become responsible not only for flight operations but for airport management and operations as well.

As at the end of 1994, the new DCA organization was yet to be completed at lower levels of authority. Fig. 4-2 shows the provisional organization chart of the new DCA.

There are 6 administrative and technical divisions: Administrative, Air Navigation, Telecommunications, Air Transport, Aerodromes and Finance; and 4 field units: Domestic Airports, Wattay Int'l Airport, Civil Aviation Training Center, and ATS Division.

Many airport development projects are now under plan or being envisaged or implemented by the Lao Government. Such development projects will hereafter come under the responsibility of the Capital Works Implementation Unit (CWIU) which is a separate organization independent of any of the organizational units shown in Fig. 4-2. The CWIU's key personnel, however, will consist of the concurrently assigned managers and assistant managers from the divisions and field units shown in Fig. 4-2.

Fig. 4-2 DCA Organization Chart



Notes; Subdivisions under each division are not formed yet.

Current number of staff/former NAAL:280~290, DCA:17, CATC:10

Pending completion of the new DCA organization, the Department is now being operated by the former NAAL staff of 290 people plus 17 from the old DCA, and 10 from the Civil Aviation Training Center, totaling in an initial staff of 320, which will be increased gradually in the future. The UNDP is preparing a comprehensive staff training program. As the airports and air navigation facilities are developed in the future, UNDP will help increase the personnel as required and also support their training.

4-1-4 Airport Maintenance Management System

Along with the operational/administrative responsibility, overall responsibility of airport maintenance management has also been transferred to the new DCA after it has integrated NAAL. Provider of maintenance services may differ by facility and by airport. In the case of Vientiane International Airport, airfield and terminal facilities are to be maintained by the Wattay International Airport Division of the DCA, while navigational aids are to be looked after by the ATS Division. Present maintenance system at Vientiane Airport is not adequate, and consequently the Airport is not maintained properly. As airport development program progresses in future, airport maintenance system will also be improved with reinforcement and training of the maintenance personnel, establishment of the maintenance manual, etc.

4-1-5 Airport Finance

Table 4-1 shows the financial summary of the Vientiane International Airport for the last 5 years. Following the organizational revision of 1991, the overflying charges revenue and the related expenditure, which were formerly included in the Airport's accounts, have both been excluded therefrom, resulting in a decrease in the Airport's revenue and the expenditure. Nevertheless, the Airport has managed to earn a profit each year, with the revenue always exceeding the expenditure.

Of the 1993 revenue of 643 million kip (approx.92 million Yen), 124 million kip (17.7 million Yen) comprises the government subsidy equal to 20% of the revenue. Expenditure in 1993 amounted to 575 million kip (82 million Yen). producing a profit of 68 million kip (9.7 million Yen), which is hardly enough as investment funds for rehabilitation.

Table 4-1 Last 5 Years' Finance at Vientiane Airport

(Unit:thousand kips)

Year	Income	Expenditure	Balance
1989	2,551,001	1,424,865	1,126,136
1990	5,499,717	3,142,773	2,356,944
1991	521,586	346,063	175,524
1992	857,168	664,581	192,586
1993	642,906	575,202	67,704

In 1994 DCA as a whole requested a budget of 1550 million kip (220 million Yen) to cover the various airport rehabilitation projects throughout the country, of which 1000 million kip is ear-marked for Vientiane International Airport.

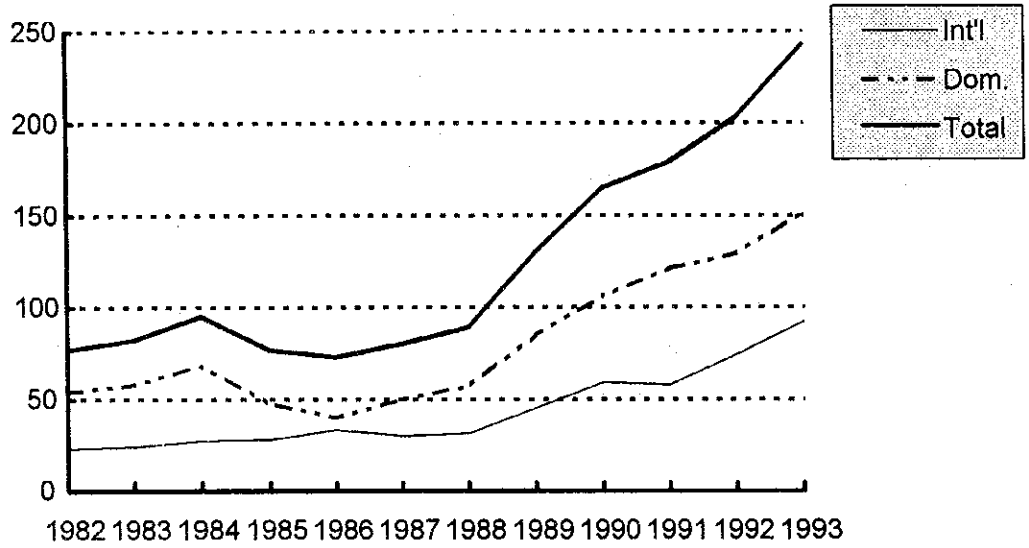
4-2 Air Transport Demand

4-2-1 Air Passengers

Fig. 4-3 shows the annual passenger traffic recorded at the Vientiane International Airport during the last 12 years.

Fig. 4-3 Evolution of Air Passenger Traffic at Vientiane

(Unit:thousand passengers)



	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Int'l	23	24	27	28	33	30	31	45	59	58	74	92
Dom.	54	58	68	48	40	50	57	85	106	121	129	151
Total	77	82	95	77	73	80	89	130	165	179	203	243

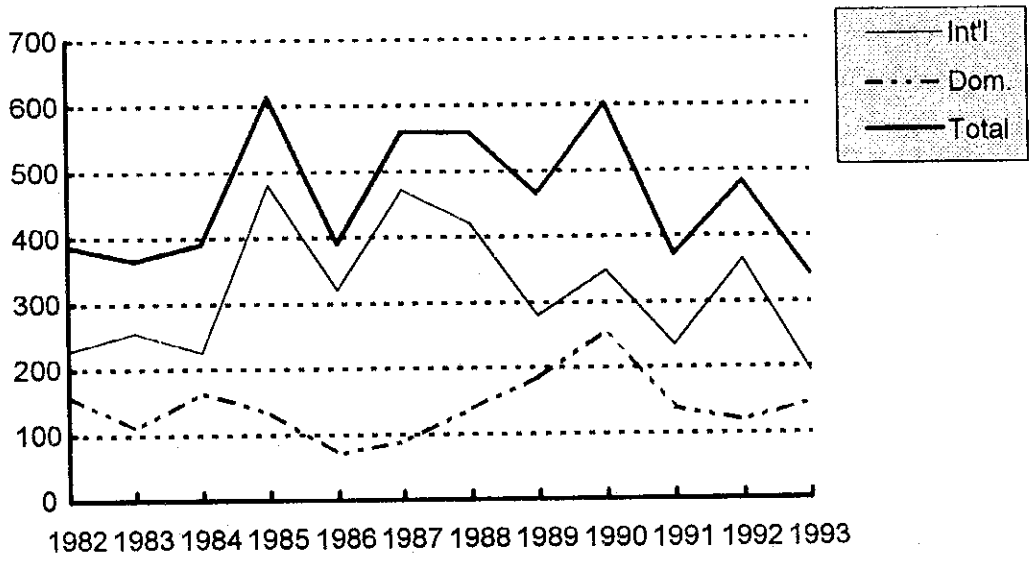
During the period of last 12 years, annual air passenger traffic started to show a sharp increase from 1989 onward in contrast to the preceding motionless period. The remarkable change apparently is attributable to the political open-door policy and to the introduction of the new market-oriented economic mechanism. An average growth rate of over 20% has since been recorded, both in international and domestic services. In the case of domestic service in particular, seating capacity shortage due to the limited airline fleet is causing serious inconvenience in flight reservation.

4-2-2 Air Cargo

Fig. 4-4 shows the annual air cargo tonnage recorded at Vientiane International Airport during the last 12 years.

Fig. 4-4 Evolution of Air Cargo Tonnage at Vientiane Airport

(Unit:tons)



	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Int'l	228	255	226	481	320	472	422	279	348	234	364	195
Dom.	160	111	164	133	70	88	137	186	255	138	119	147
Total	388	366	390	614	390	560	559	465	603	372	483	342

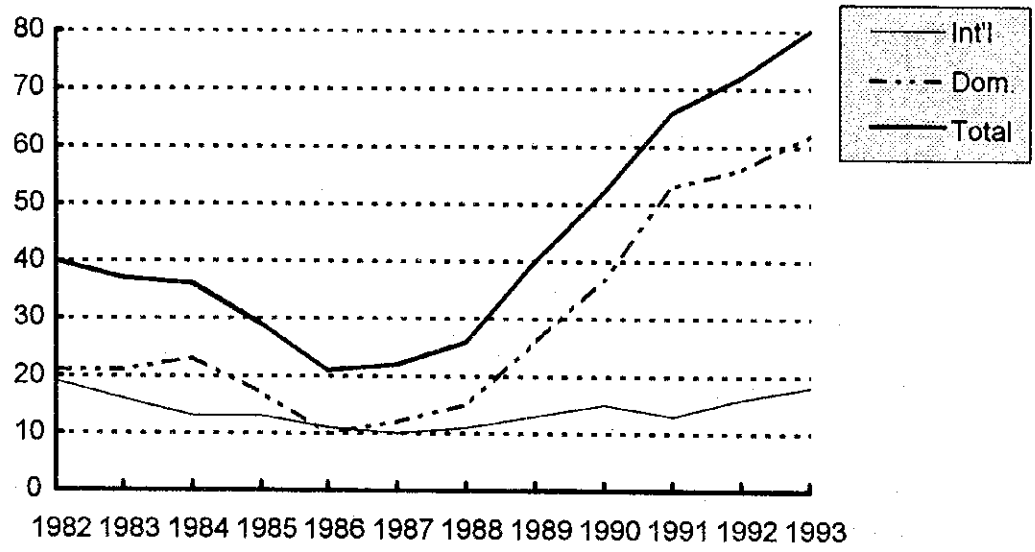
Air cargo tonnage fluctuates vigorously from year to year, but has shown little increase over the total period of 12 years. Principal Lao products distributed domestically and across the border are not quite fit for air transport. Recent completion of the "friendship bridge" connecting to Thailand has enhanced relative advantage of the road transport over the traditionally dominant water transport. These factors should explain the poor past performance as well as the grim future outlook of air cargo in Laos.

4-2-3 Aircraft Movements

Fig. 4-5 shows the civil aviation aircraft movements recorded at Vientiane International Airport during the last 12 years.

Fig. 4-5 Evolution of Aircraft Movements at Vientiane Airport

(Unit:hundred movements)



	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Int'l	19	16	13	13	11	10	11	13	15	13	16	18
Dom.	21	21	23	17	10	12	15	26	37	53	56	62
Total	40	37	36	29	21	22	26	40	52	66	72	80

Aircraft movements have evolved more or less in a similar pattern to those of air passengers, registering an identical average growth of over 20% per annum for the last 12-year period. The particularly noteworthy growth in domestic service may be explained by the introduction of ATR42 as a major contributor to operational efficiency enhancement. Serious capacity shortage being experienced today and expected to aggravate in future should be solved. Early development of airports and introduction of modern fleet are the practical measures to be taken to that end.

4-3 Conditions of Existing Airport Facilities

4-3-1 Airfield Facilities

When the Airport was opened in 1962, runway was only 2000 meters long, and there was no rapid exit taxiway. In the early '70s the runway was extended by 1000m to the present length of 3000m, and at the same time the present taxiway system was also completed. No further major expansion or improvement has been made, and the pavements are seriously damaged. Particularly the original part of the runway pavement shows significant cracking and sealing deterioration.

Runway strip is covered with thick weeds about 50-60cm tall, having received little maintenance. As mentioned earlier, the Airport, of which the ground level is lower than the flood water level of the adjacent Mekong River, suffered floods three times around 1970, but since the subsequent completion of the embankment, no further flooding is recorded at the Airport. Similar to the runway and taxiways, apron pavements are also seriously deteriorated.

The stormwater drainage system of the airfield facilities consists of unlined drain ditches of trapezoidal section, one running east-west parallel to and between the runway and the parallel taxiway, and another running between the parallel taxiway and the apron. Both drain ditches are intersected at right angle by a connecting ditch of similar structure. A concrete box culvert is provided at each intersection. The system leads the airfield stormwater to the north direction for ultimate discharge out of the airport compounds.

As for the terminal area drainage, an airside open channel made of concrete lies along the building-side edge of the apron, then runs from around the western end of the apron toward the runway strip and connects to the above-mentioned unlined ditch running along the parallel taxiway. On the landside, a U-shaped channel of concrete cast in situ on the east side of the existing passenger terminal area and in front of the passenger terminal building connects to the apron-edge

open channel. The terminal area surface water, therefore, flows westward as a whole, and through the apron-edge open channel and the unlined airfield ditch, is led across the runway and ultimately discharged off the airport on the north side.

The existing unlined airfield ditches show the sides falling down in many places, and the bottom topped with loose earth, sand, grass and tree leaves, causing the effective flow section to be badly deformed, thereby significantly impairing the drainage efficiency.

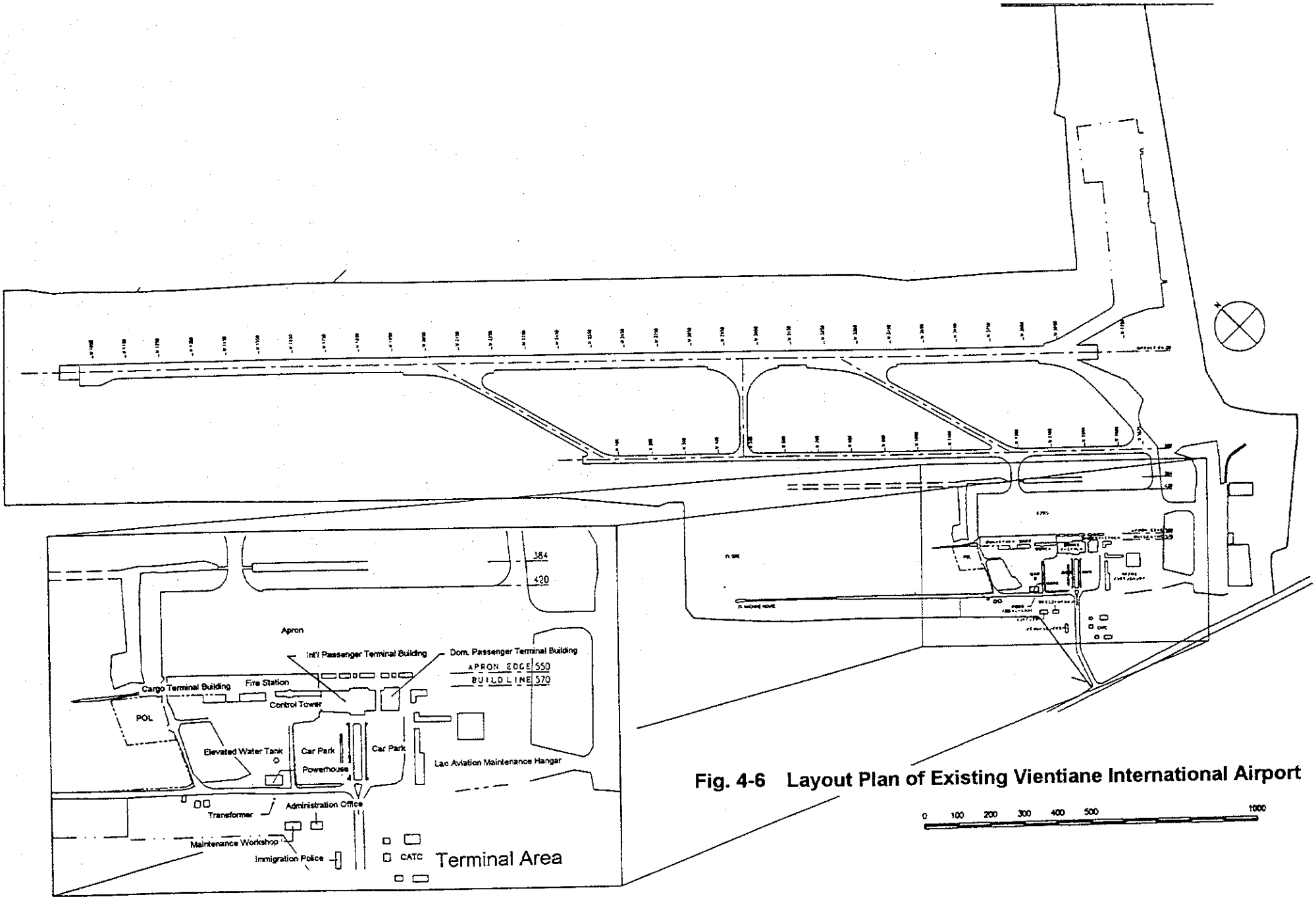


Fig. 4-6 Layout Plan of Existing Vientiane International Airport

4-3-2 Terminal Facilities

(1) International Passenger Terminal Building

Reinforced concrete, 2-level structure, total floor area 4,043m^2 (1F 2,693m^2 2F 1,350m^2), built 1965

- Has undergone remodeling and improvement 3 times in the last 30 years; Paint delamination, surface cracking and roof leakage were observed.
- Top of the ground level departure holding lounge is open, and no partition separates the lounge from the observation deck on the upper level. This poses a security problem.
- In the entrance hall, which serves as common departure/arrival lobby, the entrance to the departure security check area and the exit from the arrival customs area are located too close to each other, and the layout fails to produce clearly separated two-way passenger flows. The terminal space is too small to adequately accommodate passengers and well-wishers. In busy hours, the confusion and congestion are serious and many well-wishers are seen overflowing from the building.
- Two baggage claim conveyors are both straight linear type and often cause baggage jam.
- Public address system has poor sound quality, and is hardly audible amid ambient noise, especially in the departure holding lounge whose top is open and is directly connected to the outdoor open space.
- The offices and restaurants are air-conditioned by window-type equipment, and the duty-free shops by large package-type equipment. Other areas of the terminal are not air-conditioned.

(2) Domestic Passenger Terminal Building

Reinforced concrete 2-level structure, total floor area 1,377m^2 (1F 729m^2, 2F 648m^2), built 1965

- Though constructed in the same year, the domestic building is aged to a lesser degree than the international building.
- One-and-a-half-level system accommodates departure lobby on the upper level and the arrival lobby on the ground level, but the flow of checked-in departing passengers on their way to the departure holding lounge on the upper level crosses the flow of arriving passengers.
- Immigration control is imposed on domestic travelers.
- Security check area accommodates arms declaration counter.

(3) Control Tower and Operations Building

Reinforced concrete 4-level structure, control tower on the 4th level, total floor area 959m^2 (1F/2F/3F/4F 418/404/108/29m^2)

- Facilities in general are aged.
- Control tower is not high enough to provide appropriate field of vision for the controller. Vegetation on the green belt between the runway and the taxiway is obstructing the controller's view of the runway end area.
- Flight information center is not sufficiently soundproofed to counter the high noise level produced by the HF equipment.
- Corridor is not enclosed and not protected from rain and wind.

(4) Cargo Terminal Building

Reinforced concrete single-level structure, total floor area 835m^2

- Facility is relatively new.
- Building has large enough space to handle current cargo volume, as well as to cope with future expansion of facilities.

(5) Fire Station

Wooden single-level structure, total floor area 345m^2

- Garage is large enough to house only two vehicles, and the three engines donated by the USA in March 1994 are left outdoors.
- Capacity of the existing rapid intervention vehicles and that of the fire engines both conform to the relevant ICAO Code Number 4. Conformity with ICAO Code Number 6 is required in order to accommodate B737.
- Station offices and other staff accommodations are aged and inadequate.

Existing Fleet	Pump Type	Tank Capacity	Discharge
One 1982 Dodge	Rozenbauer	Water 940L Foam 160L	1700L/min. at 10 Bar
One 1982 Benz	Rozenbauer	Water 4000L Foam 500L	6000L/min. at 10 Bar

Three 1990 Walter Int'l vehicles to be assigned to local airports.

(6) Maintenance Workshop

Reinforced concrete single-level structure, total floor area 264m^2

- Contains several shops equipped for simple repair work, each shop being accommodated with a store within the shop area. No separate store room is provided.
- Two rooms are presently occupied by the Capital Works Implementation Unit (CWIU).

(7) Powerhouse

Reinforced concrete single-level structure, total floor area 290m^2

- Provides emergency power supply to terminal buildings and navigational aids. Power is generated by:
  two 150KVA 1981 Dale (UK) generating sets, and
  three 95KVA 1960 AGE (German) generating sets
  with aggregate capacity totaling approx. 600KVA.
  The 1960 model generators, however, are already out of spare parts supply.
- The standby generating system as a whole is aged.
- The powerhouse is located in front of the planned new international passenger terminal building, and interferes with the construction of roads and car parks.

(8) Power Receiving and Step-down Transformer

Two outdoor cubicle type transformers, 22KV 50HZ (3 ϕ, 4W) 250KVA

- Two 250KVA outdoor cubicle type transformers are installed in front of the powerhouse, each individually providing the commercial main power supply to the building group and the navaids group. The present capacity is not sufficient to accommodate the power demand of the facilities improved under the present development plan.

4-3-3 Air Traffic Services, Air Navigational and Communication Facilities

(1) Air Traffic Services

1) Air Route Traffic Control

The air route traffic control service currently being provided within the Vientiane FIR (Flight Information Region) is of a very limited quality. The short-wave (HF) radio is the only means of air-ground communication available between the Vientiane Flight Information Center and the aircraft flying within the Route A-1 over the southern part of Lao PDR, which is the busiest international air route in the Vientiane FIR and consequently has the heaviest overflying traffic. The HF radio communication is seriously affected by adverse meteorological conditions and during certain hours of the day.

No radar control service is provided to the overflying aircraft.

In spite of the fact that an average of 100 daily overflights are recorded and are yielding a substantial overflying charges that constitute a precious contributing factor to the balance of payments improvement for Lao PDR, the current enroute ATC service provided by the country seriously falls short of the international service standard.

There are at present a total of the following 5 air routes within the Vientiane FIR including the above-mentioned A-1:

A-1	Hong Kong - Bangkok	Int'l Route
B-465	Hanoi - Chiangmai	Int'l Route
B-474	Hanoi - Vientiane	Int'l Route
W-35	Luang Prabang - Vientiane	Domestic Route
W-76	Savannakhet - Vientiane	Domestic Route

Establishment of a new additional air route, Route A-2, is under plan between Hong Kong and Bangkok to help ease the congestion on the existing Route A-1, but due to the problem involving the China FIR, the plan has not materialized to date. The level of ATC service to be provided on the planned Route A-2 which will pass over Savannakhet if and when established, cannot be expected to improve very much over the present level.

In general air route traffic control is provided by Area Control Centers (ACCs). In the case of Vientiane FIR, however, the service is provided in the following manner:

A-1 and B-465 : Flight Information Center provides the overflying aircraft with the Air Traffic Advisory Services by HF air-ground communication system.

B-474 and W-35 : Vientiane Control Tower provides ATC service by VHF air-ground communication system.

W-76 : As in the above, Vientiane Control Tower provides ATC service by VHF air-ground communication system.

2) Control Tower

Existing control tower is providing aerodrome control and approach control. Consoles provided in the Control Tower comprise:

Approach control console
Auxiliary Console
Flight Progress Strip Console
Assistant Console
Aerodrome Control Console
Supervisory Console

AFTN (Aeronautical Fixed Telecommunication Network), which is the worldwide ICAO system used for the AIS (Aeronautical Information Services) purposes, covers Laos through its regional center in Bangkok located at Aero Thai Communication Center. In this system, teletyped message is kept in memory and sent out whenever the network circuits are free. Communication quality is not the best but is serving its purpose. Teletypewriters and other equipment used in the system are aged and need urgent renewal.

Direct Speech Circuit used for inter-controller voice communication connects Laos with the neighboring countries through the Aero Thai Communication Center in Bangkok as in the case of AFTN. HF radio communication is used in parallel in order to supplement the capacity shortages, as well as to complement the poor communication quality of the HF system international telephone line.

Controllers work on a 2-shift system during the service hours of 06:00 - 18:00. Present staff comprises a total of 14 controllers divided into 3 groups.

Tower equipment is generally aged, and the majority is out of service. All existing control consoles are not functioning as such, nor are the main transmitter and receiver. A minimum level of control service is barely maintained by using the only existing stand-by transmitter/receiver. As mentioned earlier, controller's field of vision is not appropriately secured due to a combination of such factors as:

- The tower being located off center to southeast;
- VFR room elevation is not high enough; and
- Tall vegetation around the runway is obstructing the controllers line of sight.

3) Flight Information Center (FIC)

The FIC provides flight information service to all aircraft flying within the Vientiane FIR by HF air-ground communication system. It also provides aircraft flying on Route B-465 with the Air Traffic Advisory Services. FIC's HF air-ground communications system is equipped with SELCAL (selected aircraft calling system), which, however, is not producing good communication quality because of the equipment being aged, controller not using the headset, and the room not effectively noise-protected.

(2) Communication Facilities

1) Aeronautical Fixed Communication Facilities

Aeronautical fixed communication system is for the exchange of aeronautical information relating to flight safety, air traffic, flight operations and air navigation between one another of the aeronautical ground stations and the neighboring countries.

2) Aeronautical Mobile Communication Facilities

Aeronautical mobile communication is a two-way communication between the aeronautical ground station and the aircraft either airborne or on ground, and between aircraft. The existing VHF communication facilities (181.lMHz for Aerodrome Control, ll9.7MHz for Approach Control, and 121.5MHz for Emergency use) installed at VIA control tower are not entirely unusable, but because of the console deterioration, is not actually used. In their place, a stand-by 4-channel VHF transmitter/receiver is used mainly.

The HF receiving and transmitting stations are located away from the FIC building, and the connecting cables installed 20 years ago and left unserviced ever since suffer from worsening resistance, leaks, interference, etc., resulting in the majority being unserviceable. Renewal of the cable connections are an urgent necessity.

DCA is already advancing plans to implement the urgently needed rehabilitation measures mentioned above.

The VHF air-ground communication system used by the FIC is installed within the HF transmitting station. The VHF radio wave, however, does not cover most of the A-1 air route and considerable parts of 4 other air routes. Consequently, the VHF air-ground communication within the Vientiane FIR is very limited and inadequate.

(3) Radio and Visual Air Navigation Facilities

1) Radio Navigational Aids

Radio Navaids serving the Vientiane International Airport consist of a 1 kw Non-Directional Beacon (NDB-VE) located at 20km to the northeast of the Airport and used for homing purposes, another NDB (VE) installed at 4000m on the westward runway extension, a 50W omnidirectional VOR (VTN) installed at a distance of 1950m collocated with a DME, as well as a 25w NDB (WY) at a distance of 1050m.

All these radio navigational aid facilities are not made remote-controllable from the control tower, but are only monitored by the monitoring device set in the VFR room.

ILS (Instrument Landing System) common to international airports, was once installed in 1971 but was destroyed in the political unrest in 1974. Remaining at present are the stations to house the two system components of localizer and glide path, but both are aged and not reusable.

2) Airport Lighting System

The Airport Lighting System of the Vientiane International Airport includes Simple Approach Lighting System (SALS), Visual Approach Slope Indicator System (VASIS), Runway Edge Lights, Taxiway Edge Lights and Aerodrome Beacon. All is in service with the exception of SALS, but since most of the facilities are nearly 20 years old, they suffer poor performance due to cable deterioration and equipment breakage. Furthermore, tall weeds covering up the light fixtures are obstructing the view from the aircraft.

(4) Meteorological Facilities

Surface Weather Chart, Upper Weather Chart, Weather Forecast Chart, and other necessary meteorological information is obtained from Bangkok. An anemometer sensor made in the Netherlands was installed in January 1994 on the roof top of the Control Tower. However, because no sensor is installed near the runway end area, accurate sufficiently weather information for the departing and arriving aircraft is not presently provided. Besides the new anemometer, the meteorological information room on the ground floor of the Control Tower is equipped with an older anemometer and an aneroid barometer.

The Airport is not equipped with Runway Visual Range, nor with Ceilometer that are the standard equipment at an international airport.

(5) Existing Equipment Listing

Table 4-2 and Table 4-3 show the listings of Communications and Radio Navigational Aid Equipment existing at the Vientiane International Airport.

Table 4-2 Existing Aeronautical Communications Facilities

Equipment	Manufacturer	Model	Quantity	Installed	Remarks
HF-TX	THOMSON (France)	CSFTRC-393(1KW)	2	1978	
HF-TX	JRC (Japan)	JRC-733(3KW)	2	1994	Procured
HF-RX	THOMSON (France)	CSFTRC-394(1KW)	3	1978	One is out of order
HF-TRX	SCOEMTOFOC RADIO SYSTEM (Fra)	SR-206	1		
HF-TRX	ANRITSU (Japan)	SS150L/M 100/150	4	1990	
HF-TRX	ANRITSU (Japan)	SS13A 6ch	6	1990	
VHF	TELERAD (France)	E667 T1/P(50W)	3	1973	
TX-RX	TELERAD (France)	E667 T1/9(100W)	1	1984	
VHF-TRX	NARDEUX (France)	(4W)	1		4ch TRX
VHF-TX	TELERAD (France)	EL752(100W)	2		128.3MHz within TX
VHF-RX	TELERAD (France)		1		128.3Mhz within RX
AFTN	AEROTHAI (Thailand)		1	1992	
PTTY	SIEMENS (Germany)	T-1200	11		in service 6 units only

Table 4-3 Existing Radio Navigational Aids

Equipment	Manufacturer	Model	Quantity	Installed	Remarks
NDB(L/B)	TELERAD (France)	RBT2050/2(25KW)	2	1971	
NDB(O/M)	TELERAD (France)	ARBT50100/2(50W)	2	1979	
NDB(H/B)	AEROCOM (USA)	AEROCOM5032(1KW)	2	1983	
VOR	THOMSON CSF (France)	VOR-511B(100W)	1	1983	
DME	THOMSON CSF (France)	DME- (1KW)	1	1982	
ILS	-	-	1	1971	Out of service since 1974

Country	INT'L /DOM	Position of the Reference Point		Magnetic Variation	Aerodrome Ref. Temp	Administration Authority
Lao PDR	INT'L./DOM	N 19° 59′ 00″	E 102° 23′ 10″	0° 10′ E	36.8℃	Department of Civil Aviation
Name of Airport	**ICAO Code**	**Elevation**	**Runway Direction**	**Operation Hour's**		
Vientiane/Wattay	4C	170m	TN 135° E	Aerodrome 2300 to 1100 UTC. HN		

Basic Facilities		Passenger Terminal Building		Other Facilities	
Runway Strip	3,060m × 150m	Two-Storied Buildings with reinforced concrete and concrete block		Control Tower	RC structure, Floor Area : 959m²
Runway	3,000m × 45m	[Int'l]		Hangar	For Lao Aviation/AN-24 and Mi-8
Taxiway	3,620m × 23m	Total Floor Area :	4,043m²	Refueler Facilities	Hydrant Fuel Facility : None
Apron	for B737/ATR 42	1F :	2,693m²	Fire Fighting	Fire Vehicle : 1 RIV : 1
	5 Berths : 72,800m²	2F :	1,350m²	Water Supply	City Water
Pavement	Runway :	[Domestic]		Electricity	Commercial Power : 22kv, 380v - 220v Stand-by Generator : 150KVA×2, 95KVA×3
	PCN 43/R/B/W/T	Total Floor Area :	1,377m²	Telephone	Available
	Taxiway :	Completed in 1965		Car park	Parking capacity : approximate 160
	PCN 31/R/B/W/T	**Cargo Terminal Building**		Other	Airport Maintenance Work Shop
	APRON :	One-storied building with reinforced concrete and concrete block			
	PCN 43/R/B/W/T	Floor Area :	835m²		

Condition of Neighboring City			
Name of City	Population	Location	Transportation
Vientiane	400,000	4km east of Airport	10 Minutes by Taxi

Air Navigation Facility	NDB	VOR	DME	LLZ	GS	IM	M.M.	O.M.	TACAN
	O	O	O	×	×	×	×	×	×
Control Facility	CCU	RADAR	APP	RIC	ACC	AMS	SMC	A/G	RCAG
	×	×	×	×	×	×	×	×	×
Communication Facility	INT. COM	HF	VHF	UHF	RTTY	LTY	MAS	MSS	MIC.LINK
	×	O	O	×	×	×	×	×	×
Lighting Facility	ALS	SALS	REIL	VASIS	TPEL	TDZL	RWTL	RWEL	RWYL
	×	O	×	13	×	×	13/31	13/31	O
	RWCL	TWYL	TWCL	ABN	APRON, F.L.	IWDI			
	×	O	×	×	×	O			
Meteorological Observation Facility	WIND	RVR	CEILOMETER	WX FAX	WX RADER	APT RX	BAROMETER	RAIN GAUGE	WX TELEX
	O	×	×	×	×	×	×	×	O
	RAIN SONDE	RADIO SONDE							
	×	×							

Air Transport					
		1990	1991	1992	1993
International	Arrival & Departure	58,913	58,313	74,166	92,424
	Transit	–	–	–	–
	Total	58,913	58,313	74,166	92,424
	No. of Flight	1,480	1,345	1,564	1,780
Domestic	Arrival & Departure	105,951	120,529	128,756	150,670
	No. of Flight	3,719	5,252	5,616	6,209

Table 4.4 Present Facilities of Vientiane International Airport

V Contents of Project

5-1 Project Concept

5-1-1 Study on the Validity of Development Plant

The objects of the Vientiane International Airport Development Plan are classified into 4 facility groups of 1) airfield facilities; 2) terminal facilities; 3) radio navigation aids and 4) airport lighting and meteorological equipment. Each group of facilities are developed by different countries and institutions, and this makes the development plan complex and demands truly effective coordination.

As mentioned in the previous chapters, the facilities that Japanese Government has been requested to improve are named "The Project for Rehabilitation of Vientiane International Airport," or the "project." These facilities include not only the terminal buildings but also the roads, car park, utilities, air traffic control equipment, airport maintenance equipment and fire-fighting vehicles. In other words, the object of the project is the rehabilitation of widely extended parts of the airport facilities.

Also as mentioned earlier, the passenger traffic demand of Lao PDR has increased since the government adopted the open-door policy in mid '80s. International airlines operating air routes to and from Vientiane, such as Thai Airways International, have the intention to increase their flight operations in order to cope with the increasing air traffic demand. Lao Government, however, is reluctant to accept such applications for reasons of protecting the international services of Lao Aviation, and also because of the inadequate airport facilities.

As for the domestic services, Lao Aviation has recently introduced new aircraft such as ATR-42, but such fleet modernization alone is not sufficient to meet the rapidly increasing demand. Improvement of airport facilities is indispensable. Lao Government has already started to improve Luang Prabang Airport, one of the 3 major domestic

airports in Laos, with assistance from Thai Government. Improvement of Savannakhet and Pakse Airports is also under plan with assistance of OPEC and other donors. Along with these domestic airport improvements, rehabilitation of the Vientiane International Airport as the national aviation hub is not only indispensable but is considered the most urgent necessity.

Facilities of the Vientiane International Airport were basically completed at its opening in 1962, and have since been in operation for more than 30 years without adequate maintenance. Instrument Landing System (ILS) for precision approach was burnt down in 1974 and has not been replaced to date. Approach is, therefore, being made mainly by visual flight rules (VFR). Airport lighting system is also in such inadequate condition that no nighttime landings and takeoffs are made at present. Terminal facilities were constructed in the era of small aircraft, and are, therefore, able to accommodate only such aircraft as B737 with a seating capacity of 130 or so, but not wide-bodies such as A300 carrying more than 300 passengers. As the traffic increases, introduction of wide-body aircraft will be inevitable in major air routes such as of Vientiane-Bangkok, but the existing terminal facilities are not only incapable of handling such large traffic but are unable to cope with emergencies such as fire, etc.

A bridge named Mitabappu was recently completed over the Mekong River between Thai and Laos, and construction of an expressway is now under plan between Kunming in China and Thailand through Laos. Road network in Laos has thus been gradually improved, but the country's busiest Vientiane-Luang Prabang road, for example, is still in a very poor condition. Under the circumstance, passenger traffic has to rely heavily on air transport, and improvement of airports, therefore, is high on agenda in the national transport sector development strategy.

Major export items of Lao PDR are electricity and timber, and not much of other effective means is found at present for increasing the foreign currency inflow, except for tourism, which is now expected to develop

into an industry to follow electricity and timber. Laos is rich in tourism resources, such s the ancient palace in Luang Prabang, Jar Plain, waterfalls in Korn and mountain tribal culture. Tourists, mainly from Thailand, are definitely increasing. For the due development of tourism, however, provision of adequate transportation is a must, and development of air transport infrastructure is indispensable.

Airports in Lao PDR had been operated by the National Airports Authority of Laos (NAAL) until 1994, when the NAAL was absorbed into the Department of Civil Aviation (DCA) which has taken over all of NAAL's functions and responsibilities. As a result DCA has become the sole body responsible for the operation and maintenance of the Vientiane International Airport as well as the 13 major and minor domestic airports. DCA presently has a staff of approximately 300, which is planned to be reinforced both in quality and quantity according to the staff training and reinforcement program of UNDP/ICAO. It is also expected that technical skills and knowhow of the DCA personnel in airport planning, improvement and operation will be enhanced by working together with the engineers of donor countries in the implementation of the development plan.

Having shed lights from different points of view, the study team was convinced of the validity of the development plan for the following reasons:

- Rehabilitation is planned on the basis of maximum utilization of the existing facilities;
- Airport improvement is indispensable; and
- Implementing agency is sufficiently capable.

5-1-2 Study on Contents of Request

The validity of the airport's overall development plan having been confirmed as above, the necessity and importance was recognized of establishing an optimum work plan for the rehabilitation project, which constitutes the major part of the development plan, and for which Japan is solely responsible.
Evidently it demands careful liaison with other donors under ADB's overall coordination.

As mentioned earlier, to improve VIA, ICAO prepared a master plan in 1990, and the master plan was reviewed by ADB in 1993. The study team has reviewed these plans and studies to verify the validity of the following contents of the Lao PDR.

(1) Passenger Terminal Building

As stated in Chapter IV, the existing international passenger terminal building is of about 4000m^2 in total floor area and domestic building is about 1400m^2. These buildings are operated independently. Estimated annual international passenger volume is about 250 thousand in 2005. The number is still small, but the traffic is concentrated around noon because of the departure/arrival time at airports of origin/destination. Even now, there are 3 flights concentrated in the same time period. Although annual traffic is not large, peaking coefficient is high. Remodeling of the existing international passenger terminal building is recommended in the master plan, but the required floor area to handle such peak-hour passengers is estimated to be 10000m^2 and the area to be expanded will be considerably larger than that to be remodeled. Therefore, it is much more recommendable to convert the existing international passenger terminal building into a new domestic terminal, and construct a new international passenger terminal building at a different site.

(2) Control Tower and Operations Building

Construction of a new control tower and operations building is recommended because the existing facilities are aged, of insufficient space and height of the VFR room is not adequate. The existing control tower is located close to the southeast end of the runway, and the controller's eye level must be more than 25m high to secure full view of northwest end of the runway. The height of the existing 4 storied control tower is only 12m high, furthermore tall bushes in the runway strip are obstructing the controllers' view of the most of the runway surfaces. It is recommended that a new control tower and operation building with sufficient height and capacity be constructed at a separate site, and that thereafter a new international passenger terminal building be constructed at the existing control tower site.

(3) Fire Station

The existing fire station is located next to the control tower. It is a simple wooden structure and has a garage space for only two fire-fighting vehicles. Since fire fighting vehicles are upgraded to accommodate future operation of wide-body jets such as B767, it is recommended that the existing structure be demolished and a new fire station be located at new site.

The site of the existing fire station and control tower are located between the existing international passenger terminal building and the cargo terminal building, which is suit for a site of the new international passenger terminal building. It should therefore be used as such.

(4) Powerhouse

The existing powerhouse located next to the car park is in a fair condition, but it must be expanded so as to be able to house the equipment to meet the future increase in power demand.
Since its present location will be directly in front of the new international passenger terminal building, it is a suitable site for the new car park and shall be utilized as such, taking passengers convenience into account. The new powerhouse shall be constructed at a new site.

(5) Airport Maintenance Workshop

There is no airport maintenance workshop particularly built as such. A small building, which is partly used as DCA's project implementation office, is used as the airport maintenance workshop at the moment. Airport maintenance equipment is now kept in the small garage next to the existing fire station, but most of the equipment is left exposed to weather. These existing maintenance facilities shall not be utilized and be entirely replaced by a new facility.

(6) Roads, Car Park and Stormwater Drainage

The existing roads and car park shall be utilized as much as possible as an integral part of the new terminal area plan to be made with due consideration for the layout and requirements of each facility.
With due consideration for the existing stormwater drainage system of the airport, which is planned for ultimate discharge to the south of the airport site, the route and capacity of the new stormwater drainage system of the terminal area shall be determined through careful coordination with ADB, which is responsible for overall airfield facilities of the airport.

(7) Power Supply Facilities

Current cable condition and routes of some major equipment of the power supply system are not clearly known, but considering the long years from installation and apparently poor maintenance, it does not seem appropriate to examine them in details to determine whether they are usable or not. Therefore, all necessary equipment shall be replaced in a manner to ensure the total system integrity and to meet the future power requirements both in capacity and quality, especially in reliability of supply.

(8) Water Supply Facilities

Water had previously been supplied to the airport facilities by gravity from the elevated water tank, but since the Vientiane city water supply was started, it is now supplied directly from the city water system because there are no high points to be supplied in the airport. Under the present rehabilitation project, gravity supply system shall be reinstalled since there will be some high supply points such as control tower and international passenger terminal building. The existing elevated water tank will occupy a space in front of the new international passenger terminal building to be developed, just like the existing powerhouse. Since the location is suitable for the new car park space, the existing elevated water tank shall be removed to a suitable new site.

(9) ATS, Air Navigation and Communication Equipment

Control and communication equipment needed primarily for aerodrome control shall be developed under the Project. Radar equipment shall not be included. The existing VOR/DME can be used for instrumental approach but mostly not used and visual flight rules are mostly taken at this airport. Navigation safety will be remarkably improved by installation of D-VOR/DME by France in December 1994 and by ILS facilities to be renewed under the Project. Development of radar system is recommended when radar control service becomes necessary in future.

(10) Fire Fighting Equipment

The existing fire-fighting vehicles are usable to some extent, but when considering their limited reliability and difficulty of spare parts supply, total replacement of the entire fleet is desirable along with the training of the operational staff under this Project. It is recommendable to procure these vehicles and equipment from a single manufacturer as much as possible, since it is uneconomical to carry spare parts of many different manufacturers.

(11) Airport Maintenance Equipment

The existing airport maintenance equipment are aged and unusable except for the small sweeper which is actually used. Airport maintenance equipment needs to be procured according to their requirements to be determined when adequate airport maintenance program is identified under the Project.

The VIA development plan in the master plan prepared by UNDP/ICAO and its review report by ADB, which form the basis of Lao PDR's request, are found to be generally acceptable by the study team as described above. There is some room for improvement in facility layout, etc. as stated in the following.

The basic philosophy in ADB's review is the maximum utilization of the existing facilities, and while this may help minimize the investment cost, the result at development plan is not necessarily for future expansion flexibility. This airport is in a transitional stage where the air traffic demand has just started to increase and has a potential for growth beyond estimation in future. The new facilities to be developed in this Project should, therefore, have sufficient flexibility to cope with the future demand, otherwise they may need to be renovated again in the near future.

Expandability is considered to be the most important factor in the terminal area layout plan, but in ADB's review report, the new fire station and control tower are assigned a site which will be needed for future apron expansion, will apparently become obstacles sooner or later. These facilities shall therefore be located in the airport administration area under the Project. With this, a few other improvements such as securing the space for underground piping and cabling duct on the airside of the terminal area, and securing car park space in front of the new passenger terminal building, the ADB's review report is considered to be quite appropriate.

As for the air route surveillance radar and ILS, which Lao PDR requested to be added to this project after the second site survey in Laos, the study team reached the following conclusions.

Air route surveillance radar shall not be included in the present project for the following reasons;

- Since coverage of the radar extends all over the country, its installation by far exceeds the original intended objective of the Project, which is rehabilitation of the airport.
- Area Control Center (ACC) with adequate equipment and trained personnel needs to be established.
- It requires many other incidental items to be developed such as improvement of communication system.

Instrument Landing System (ILS) had been in operation until it was burnt down in 1974 and has not been replaced. It is recommended that ICAO was promoting switching from ILS to MLS by mid 1990's, but with the recent development and widening use of the satellite-based global positioning system (GPS), introduction of MLS has suffered a major setback. Choice of such a system is now optional in recent new airport development projects all over the world. Determination of whether to install ILS or introduce GPS should preferably made after ascertaining the prevailing tendency of GPS. This situation, however, is not quite clear yet at present, and since time is of essence, the study team has chosen to include ILS in the Project.

As a result of the examination, validity of implementing the Project with Japanese grant aid was confirmed owing to its effectiveness, practicability and capability of the project executing agency of Lao PDR, and also because the effects of the project fit the objective of the Japanese grant aid system. Based on the above judgment, the study team proceeded with the basic design of the Project, incorporating the revisions to the ADB-reviewed plans and contents of request by the Lao Government as stated in the preceding paragraphs.

5-2. Objects of and Objectives of the Project

As stated earlier, the traffic demand has been increased at a high rate after the introduction of the open-door policy in mid '80s. It is expected that passenger demand of air transport will increase as the economic activities are stimulate. But insufficient transportation infrastructure enable to accommodate such growing demand is constituting a bottleneck in the country's economic development.

Overall objective of this project is to overcome the bottleneck by improving VIA as a center of national civil aviation along with the major domestic airports of Luang Prabang, Savannakhet and Pakse, as well as the air navigation facilities, that are being improved by other donors.
In VIA, this project aims at improving the terminal area facilities including the passenger terminal buildings, as well as the air navigation and communication facilities and other necessary equipment in order to operate and maintain the airport at a service level worthy of the national gateway airport, and at the same time to enable the airport to play a leading role in the PDR's economic development.

5-3. Project Implementation Program

5-3-1 Project Implementation Organization

This project will be implemented by Department of Civil Aviation (DCA) which belongs to the Prime Minister's Office (PMO). Re-organization of DCA is yet to be completed including the planned integration of National Airport Authority of Laos (NAAL) is now underway.

Actual works of implementation are to be performed by a section named Capital Works Implementation Unit (CWIU) initially composed of ten (10) engineers and specialists of related fields, which is established independently from other sections of DCA to specialize in implementation or airport projects in Lao PDR. CWIU is responsible not only for VIA but also for major domestic airports of Luang Prabang, Savannakhet and Pakse and other minor domestic airports. The current size of its staff is not sufficient to deal with all such responsibilities, and there is staff reinforcement plan, but the implementation of the overall VIA development plan an expatriate consultant group is engaged to collaborate with CWIU under financial support of ADB.

As stated earlier, under the VIA development plan, the airfield facilities will be improved by ADB, terminal facilities by Japan, radio navigational aids by France and airport lighting and meteorological observation facilities by NDF. Actual coordination of these works are made by the ADB-sponsored consultant group working as the in-house consultant to the CWIU.

5-3-2 Budget

The cost is of the Lao PDR airport development plan is estimated at 44.8 million dollars according to ADB's 1993 review report. This amount includes improvement costs of VIA and other domestic airports. In which VIA occupies around 50% of the total and is estimated around 23 million dollars. The ratio of the local currency portion is approx. 2.9% of the total cost and is estimated at around 1.3 million dollars. These are very conservative estimated figure, and are subject to updating after engineering design is made by each donor.

Of all the VIA development works, the Japanese and French portions will be implemented by grant aid, while the ADB and NDF portions will be implemented by loan. This loan portion is relatively small as compared with the grant portion, and therefore the financial burden on the Lao Government should not be heavy. DCA is requesting a budget of around 1 billion kips for the overall VIA development plan.

5-3-3 Operation Program

Airports are generally operated by an organization composed of three divisions, which are operation, maintenance and administration, under an airport manager.

(1) Operation Division

Objectives of operation division are effective operation of airport and the division contains four sections which are air traffic control, airport operation, meteorological observation and rescue and fire fighting.

1) Air Traffic Control Section

Air traffic control section conducts ground control in airport restricted area, aircraft landing and take-off control and control of aircraft flying around VIA. Since the air route surveillance

radar is not installed in this Project, air route surveillance works will be continuously performed with air-ground communication equipment, and work items to be done will be as they are. Currently the ATC division is conducting these works including operation and meteorological observation and has about 130 staffs. As the works performed in the division at the moment will be continuously done after completion of the Project, it is not necessary to increase the number of staffs caused by replacement of equipment. It is recommended that the current staffs are kept and shall be well trained for efficient operation.

2) Airport Operation Section

This section will conduct the works such as approval of flight plans, air traffic information services and communication with other aviation facilities. As stated in the former section, such works are performed by the current ATC division. The current number of staffs shall be kept as same as the ATC section.

3) Meteorological Observation Section

This section will conduct meteorological observation and forecasting at the airport. These works are now performed by the ATC division, but meteorological observation facilities will be upgraded in the VIA development plan. Implementation will be done by NDF and items to be improved are not determined yet. The current number of staffs shall be kept as same as the ATC section.

4) Rescue and Fire fighting Section

Rescue and fire fighting vehicles will be increased under this Project, and the number of staff shall be increased accordingly. Current category of VIA by ICAO classification is 6, but there are only two vehicles, one RIV and one MJV, at present corresponding to only classification 4. The vehicles for

classification 7 will be procured under this project, comprising three vehicles including one ambulance. A staff of 15 will be necessary for each of the three shifts required, totaling in a staff of 48 including three administration personnel.

Maintenance works for each facilities are performed by each sections.

(2) Maintenance Division

Maintenance division is composed of three sections such as airfield facilities, terminal facilities and mechanical/electrical equipment.

1) Airfield Facilities Section

Airfield facilities section is responsible for routine inspection, easy repair, cleaning and weeding of the airfield facilities including runway, taxiway, apron and runway strip, but these are not adequately performed at the moment. It is therefore necessary to provide a maintenance manual to ensure their execution. Required equipment will be procured under this Project, and a total staff of 12 will be required after the project is implemented. Small repair such as filling of sealant and patching of cracks will be performed by DCA, but bigger repair works shall be performed by contractors.

2) Terminal Facilities Section

Terminal facilities section will do maintenance work of buildings such as passenger terminal building, cargo terminal building and control tower. Cleaning, easy repair and exchange of parts are also included in the work. Big and complex repair work will be done by contractors. A total staff of 30 will be required for this section.
Security inspection work will also be performed by this section.

3) Mechanical/Electrical Equipment Section

Mechanical and electrical equipment section will do maintenance work of such equipment in the entire airport including those installed in buildings. Routine monitoring, inspection, exchange of parts and easy repair will be included in the work. This section covers a vast variety of equipment from electronics to power supply, and will require a staff of 12.

(3) Administration Division

Administration division is composed of accounting, general affairs and statistics sections. Each section needs 3 staff taking total number of staff and airport scale into account, totaling 10 staff is required including one director.

Required number of the operation and maintenance staff will be 242 in total. This number is far beyond the current staffing level. Required staff shall be readied for service half a year before the actual operation of the new facilities to ensure smooth transfer. It is planned to provide operation and maintenance manual for routine work.

5-4. Basic Design

5-4-1 Design Policy

(1) Basic Policy

The master plan prepared by UNDP/ICAO and reviewed by ADB, shall be the base of this basic design, provided that they are updated and modified in parts to the extent deemed appropriate and desirable by the study team as stated in some details in section 5-4-3.

The reviews by the study team of the two existing planning studies was made with an added emphasis on the functional points of view while honoring the inherited principle of minimizing the development cost through maximum utilization of the existing facilities.

The following is the basic policies of the study team's review, these policies which will also be applied to the basic design,

- Facilities shall meet the demand in 2005;
- Facilities shall be designed with flexibility to accommodate the future demand;
- Implementation of the project shall not disturb the normal airport operation;
- Maximum functional efficiency shall be achieved with minimum project cost to this end existing facilities shall be utilized to the maximum possible extent.

According to the above basic policies, the basic design works are performed by the following practical methods;

- Facilities shall be suitable for the Lao climate. Especially, as the elevation of the airport is lower than the flood water level of the nearby Mekong River, the facilities shall be designed so to minimize damage of flood.

- Elements of traditional Lao architecture shall be respected and adopted in the design, while keeping harmony with the requirements.
- Facilities shall be constructed with materials and construction equipment that can be easily procured and maintained in Laos.
- Facilities shall be designed so as to be easily operated and maintained by Lao personnel.

Since four different countries and international institutions are involved in the implementation of the VIA development, close coordination among those concerned is of particular importance in achieving the trouble-free interfacing of the facilities planned and designed by different organizations.

(2) Buildings

1) Architecture

The design policy are described below.

- The design shall harmonize with traditional LAO architectural style, local climate and other features, as well as the surrounding environment.
- The level of sophistication and the size and capacity of the facilities shall be determined on the basis of the current level of operation in such a manner as to allow them to be operated and maintained by Lao personnel without difficulty in terms of budget , technology, and human resources.
- Future potential for expansion shall be taken into consideration in the facility planning.
- Since the project is to be implemented while the airport is in operation, all works shall be planned insofar as possible not to disturb the normal operation of the airport.

- Practical flood protectional measures shall be taken as follows;
  - Floor level of the ground floor shall be set as high as possible.
  - Equipment and facilities such as transformers, air conditioners, elevator machine rooms, and communication facilities shall be installed on upper floors wherever possible.
- Disaster prevention plan

  The disaster prevention plan shall be made based on the current local standards with due consideration for the size, use and surrounding conditions of each facility.
  - For fire prevention, detection and reporting, materials of building interior finishing shall be fireproof, and alarm or warning system shall be installed.
  - To prevent fire spreading, fire limit shall be established for each floor and the emergency exit stairs. Early-stage fire fighting equipment shall also be installed on each floor.
  - To facilitate evacuation, 2-way escape routes shall be secured for each fire limit.
  - Effective access routes for fire fighters shall be secured.

2) Structure

The basic structural design policy is as follows.

- Durability is an important criterion, and structural design shall be such that the facilities withstand long use.
- Simplicity shall be emphasized in the design of structures and details.
- Economy of construction shall be pursued in structural design.
- Structural design shall facilitate maximum use of locally available materials wherever possible.

3) Mechanical and Electrical Facilities

- Mechanical and Electrical facilities including the water supply, communications, hygiene and waste disposal facilities shall be designed to help create modern comfortable and functional terminal facilities of international standard.
- Equipment plan shall ensure a high degree of safety and reliability in terms of protection from fire, malfunctions and accidents.
- Equipment plan shall be made to facilitate daily operation and maintenance services.
- Materials and equipment shall be of wide application and replacement and spare parts, shall be readily obtainable locally to minimize such stock.
- Equipment and materials, as well as their installation shall be planned with due regard for the economy of initial investment and running cost.
- Equipment plan shall be made not only to satisfy all relevant local regulations and standards, but also by taking into consideration Japanese and international laws, regulations and standards of relevance as reference.

4) Terminal Special Equipment

- Terminal special equipment plan shall be made to enhance passenger comfort and convenience as well as to ensure operational safety and efficiency fit for a modern international airport to serve the national capital.
- Baggage handling facility plan shall be made so as to cope efficiently with the large volumes of hand baggage expected in future by introduction of large jets.
- Particular emphasis shall be given is the security system plan in order to ensure provision of security measures of international standard.

(3) Civil Works

1) Roads and Car Park

Planning and design policies on the terminal area roads and car park are as follows;

- One-way traffic system shall be adopted to ensure smooth vehicle flows in the terminal area,
- Clear separation of traffic shall be established at an appropriate point according to the purpose and destination of vehicular traffic,
- Maximum green space shall be provided for landscaping purposes as well as to prepare for future expansion of terminal area facilities,
- Car park configuration shall be planned with tollgates,
- Taxi and bus pools shall be planned to ensure passenger convenience,
- To minimize construction cost and time, maximum utilization of existing roads shall be sought to the extent not to sacrifice adequate access to each facility.

2) Stormwater Drainage

- Water flow of the existing stormwater drainage system shall be kept and unnecessary change of water flow and construction of new drain ditches shall be avoided,
- Adequate drainage shall be provided at every terminal facility to match the expected rainfall intensity,
- Drainage facilities shall be easily maintainable by Lao maintenance staff.

(4) Airport Special Equipment

1) ATS, Air Navigation and Communication Equipment

- Planning of these facilities shall be made to ensure due functioning of all existing facilities that are presently in different service conditions.
- Proper interfacing and system integrity shall be ensured between through close coordination with each donor concerned.
- Existing facilities shall be utilized to the maximum possible extent.
- Equipment shall be such that it can be adequately operated and maintained by Lao personnel, It shall of such manufacturers who can supply spare parts and provide maintenance services when needed,
- Equipment shall be provided with adequate back-up power supply system.
- Equipment shall be able to be expanded or reinforced to meet the future demand.

2) Airport Maintenance and Fire Fighting Equipment

- Minimum equipment needed for future airport operation and maintenance shall be provided based on the assessment of the current service level.
- Equipment shall be of heavy-duty and of simplest possible construction.
- Equipment shall be of a manufacturer who can provide sufficient aftercare and spare parts supply preferably from Laos or from neighboring countries,
- Equipment shall be extensively used, and shall also be compatible with existing equipment.
- Equipment shall be of low-cost and high-performance with high reliability.
- Equipment shall be interchangeable to the maximum extent wherever possible.