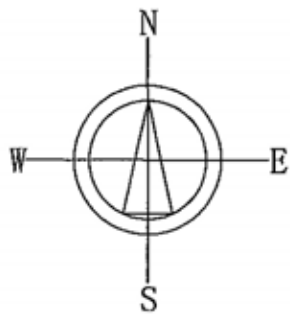


2-2-3 Basic Design Drawing

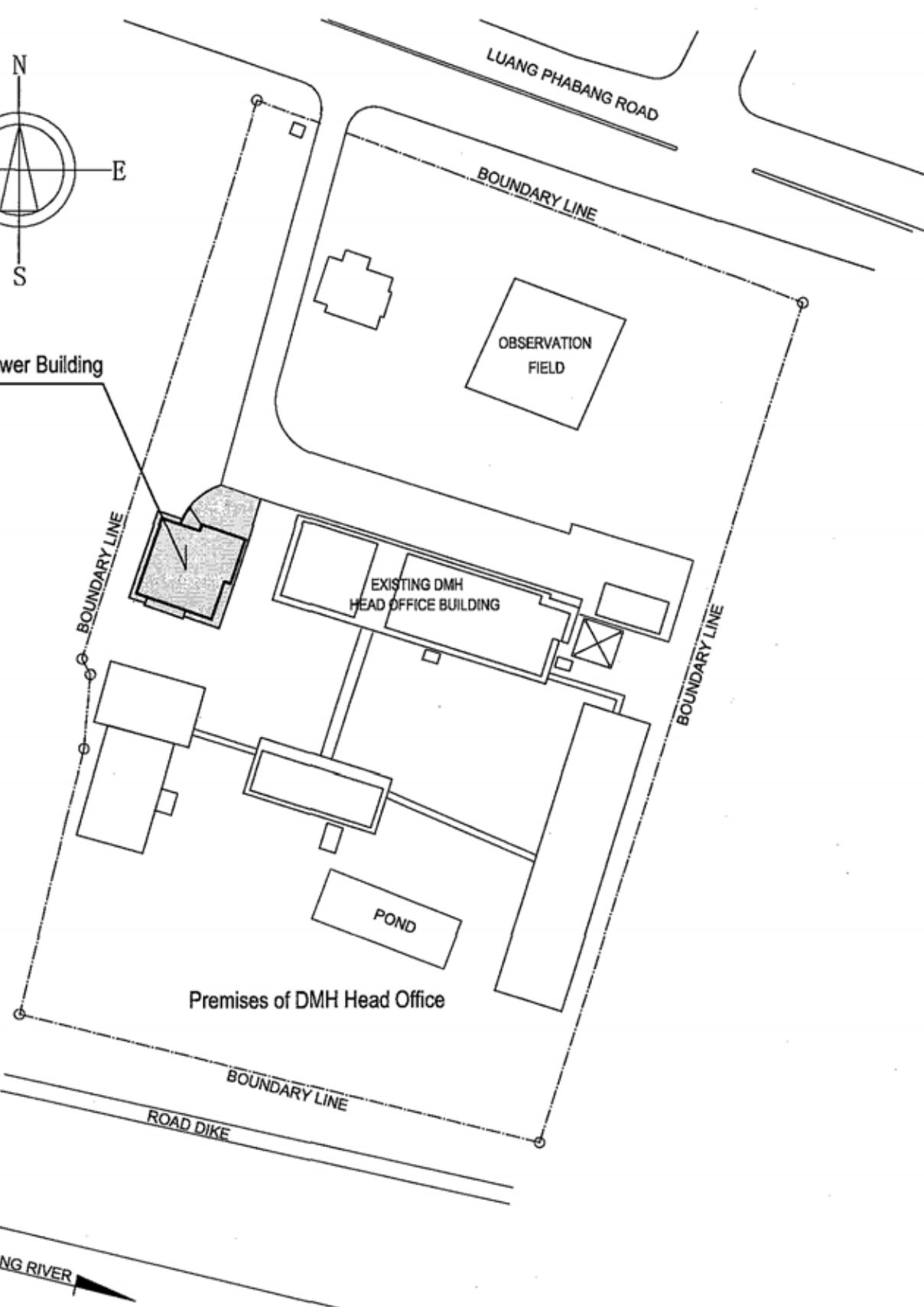
The following basic design drawings for the Project are attached from the next page.

- SITE LOCATION MAP/RADAR TOWER BUILDING LAYOUT PLAN A-01
- FLOOR PLAN 1 A-02
- FLOOR PLAN 2 A-03
- ELEVATION/SECTION A-04

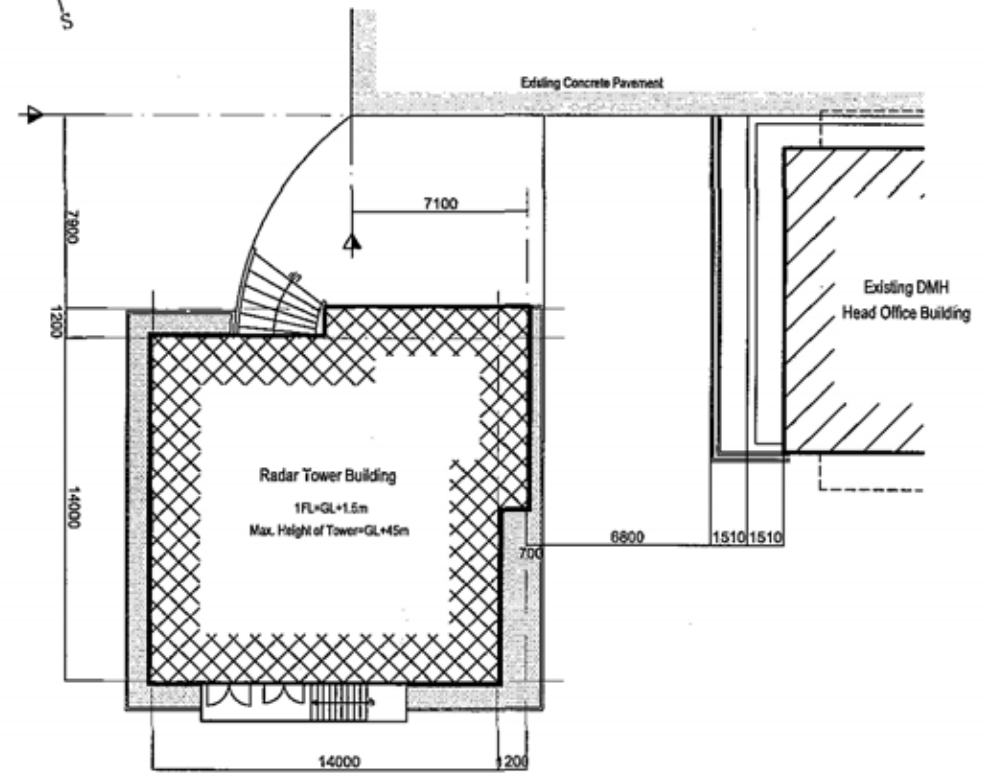
- RADAR TOWER BUILDING
EQUIPMENT LAYOUT PLAN EQ-01
- CONTROL TOWER BUILDING, VIENTIANE INTERNATIONAL AIRPORT
EQUIPMENT LAYOUT PLAN EQ-02



Radar Tower Building

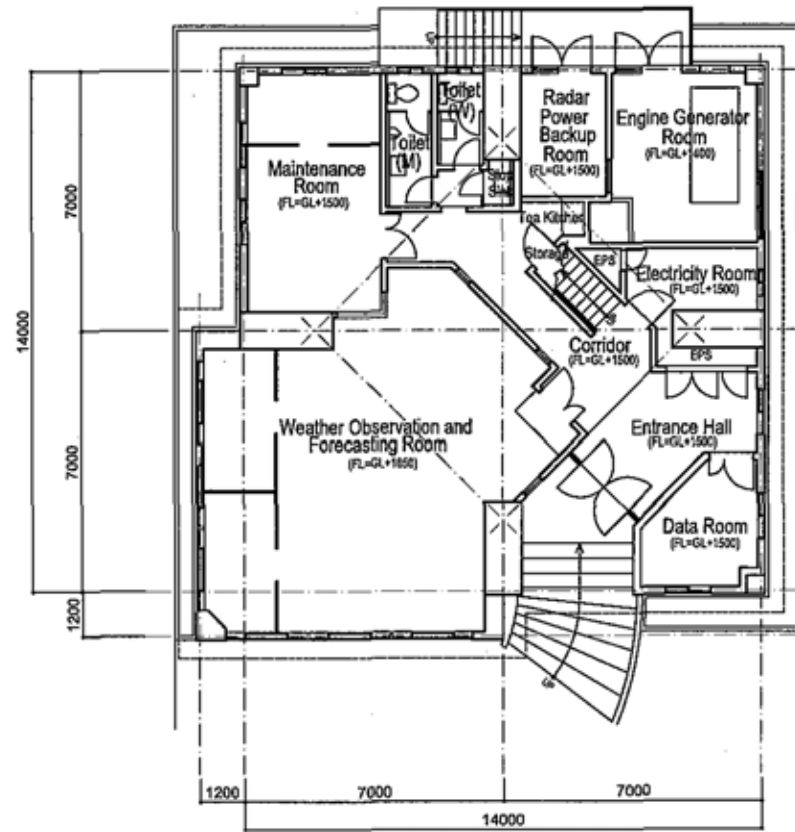


SITE LOCATION MAP Scale 1:1000

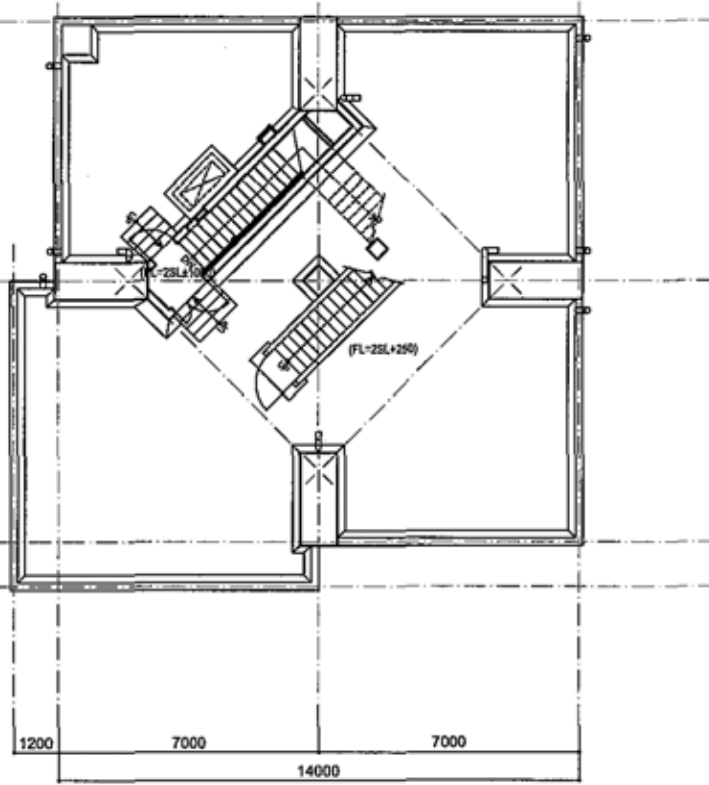


RADAR TOWER BUILDING LAYOUT PLAN Scale 1:300

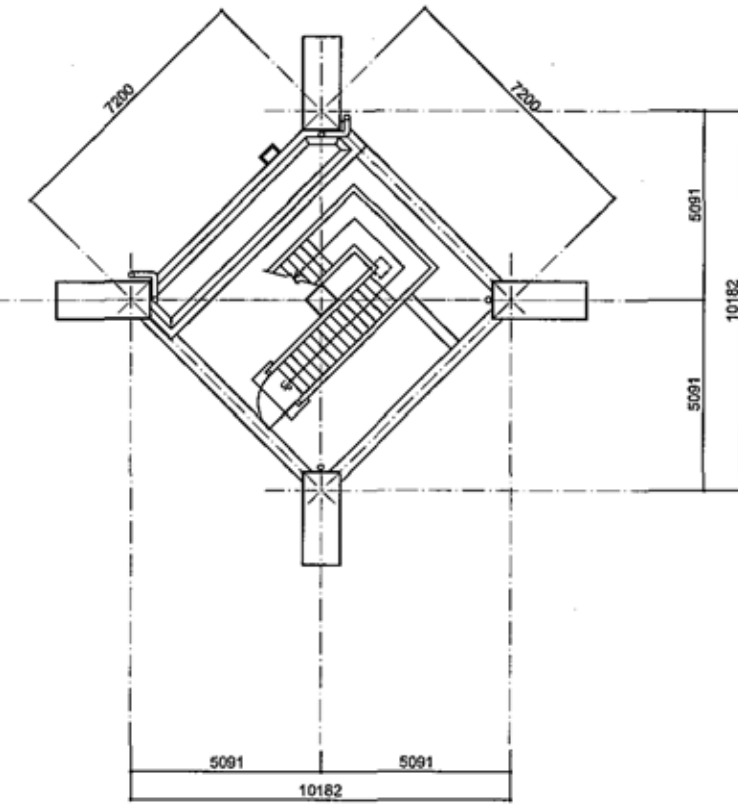
FLOOR AREA	
1F	203.59m ²
2F	8.19m ²
6F	54.76m ²
7F	13.26m ²
8F	30.17m ²
TOTAL	309.97m ²



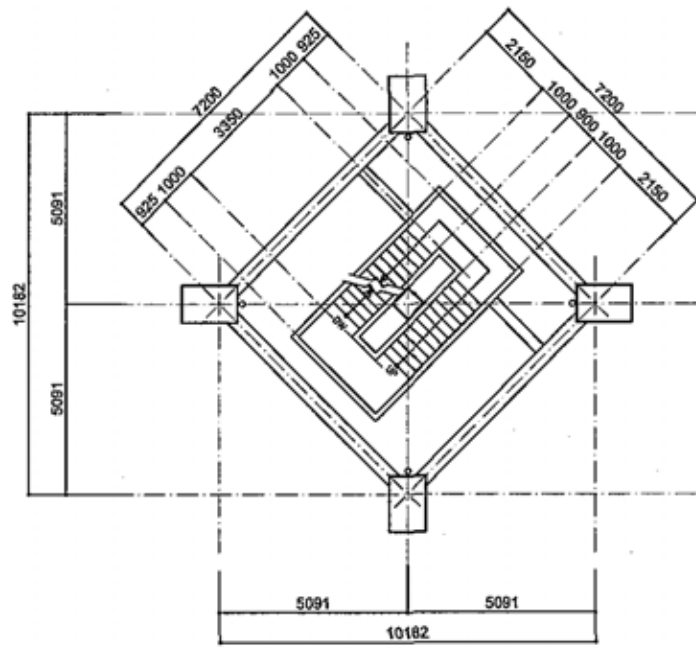
1F PLAN



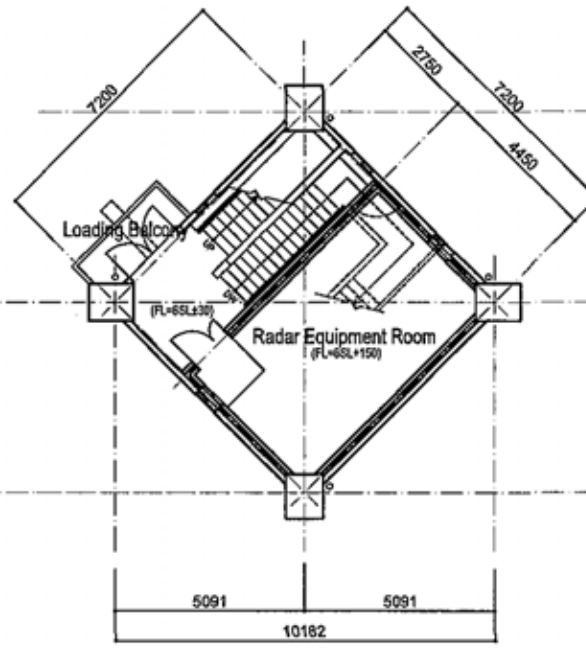
2F PLAN



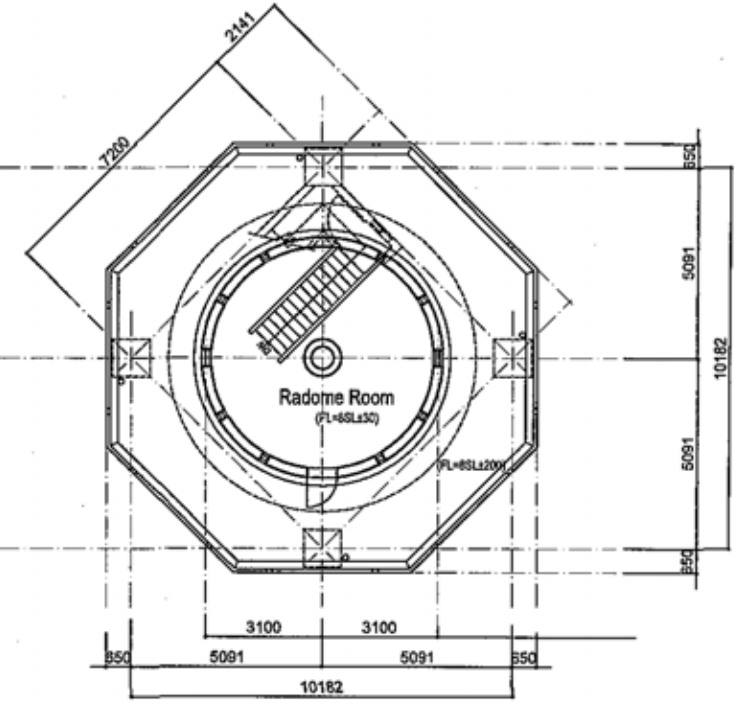
2F ROOF PLAN



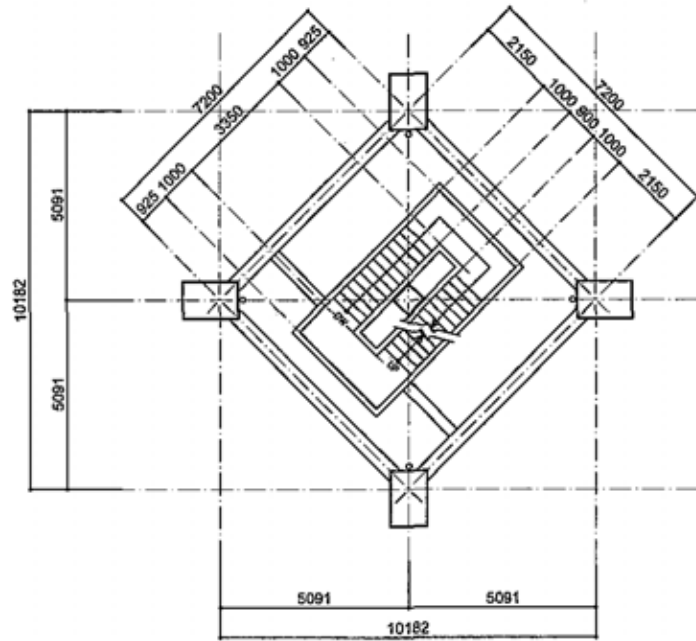
M3, M4F PLAN



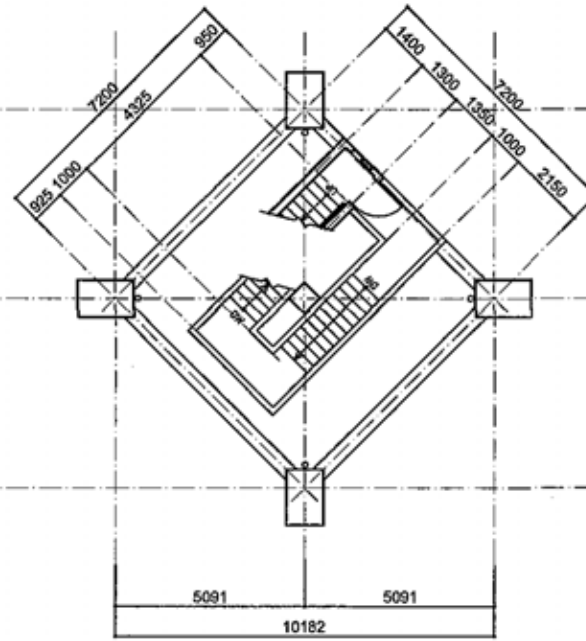
6F PLAN



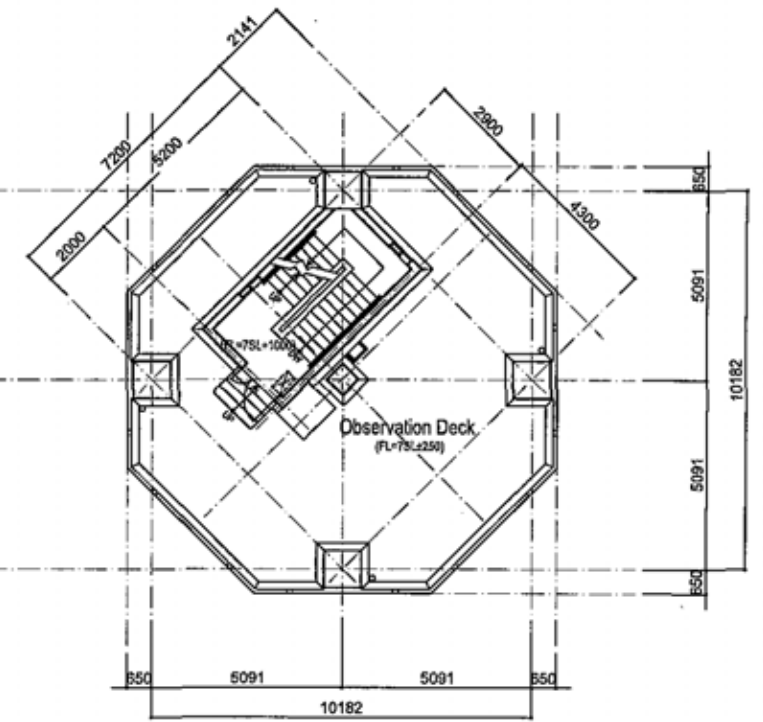
8F PLAN (RADOME FLOOR PLAN)



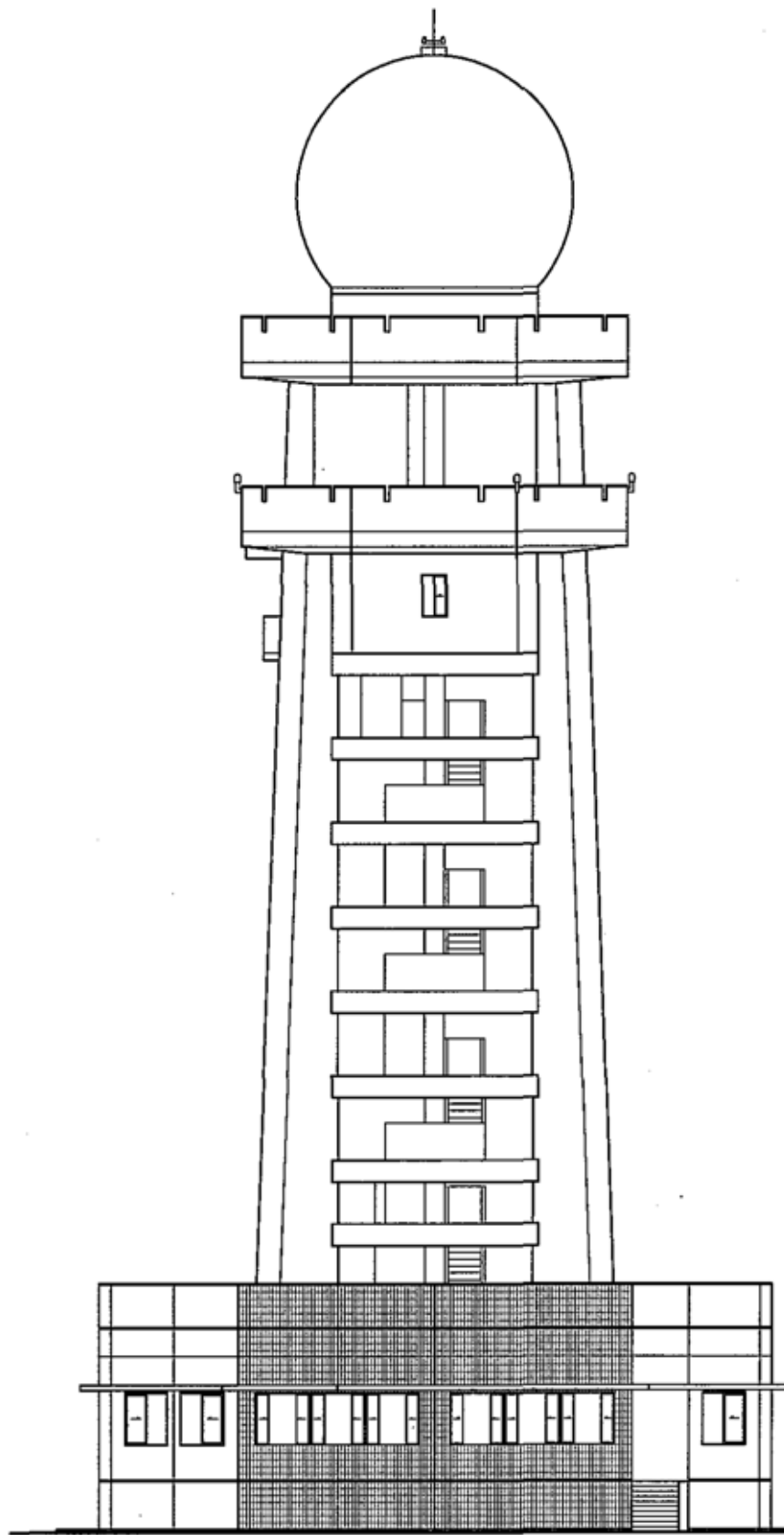
3, 4, 5F PLAN



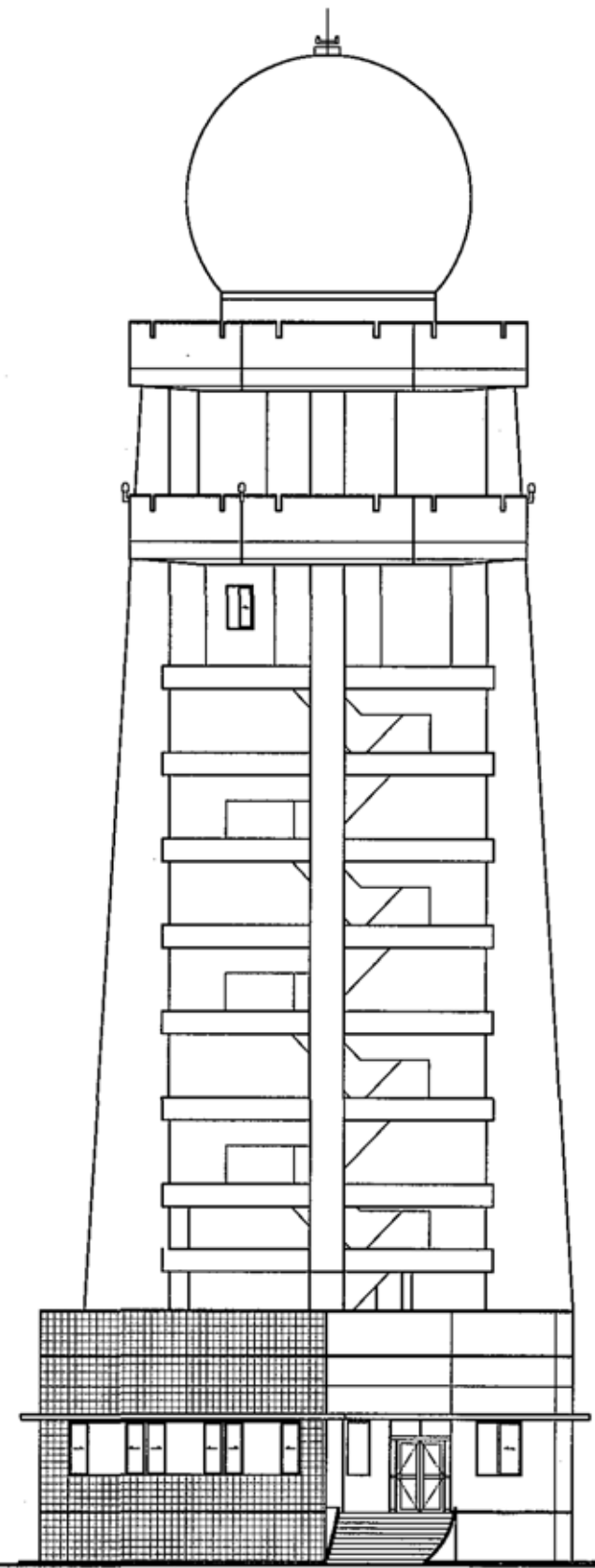
M5F PLAN



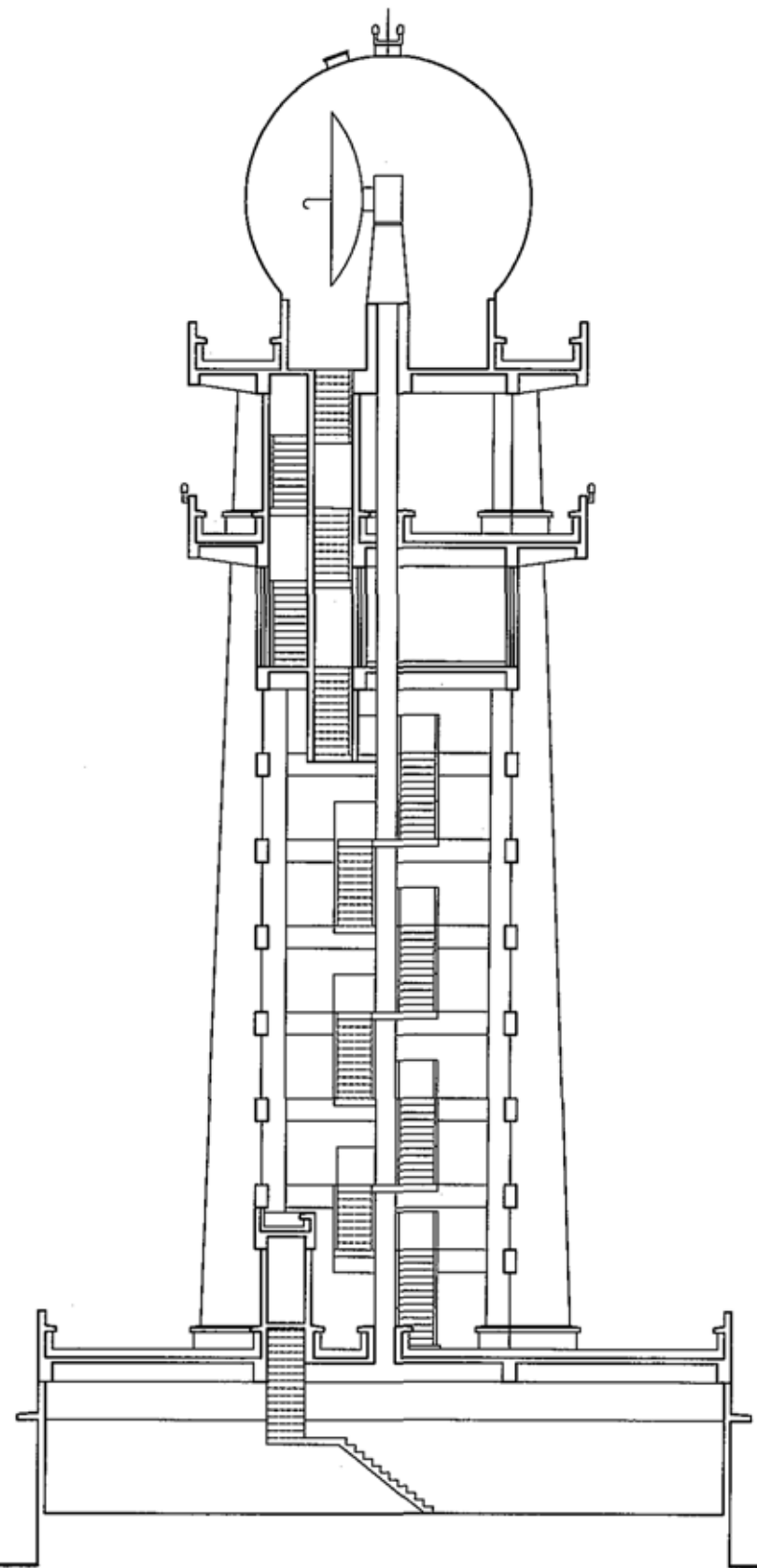
7F PLAN (OBSERVATION DECK)



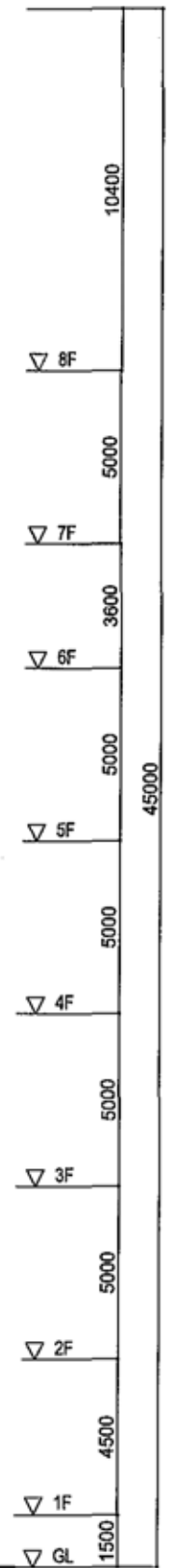
NORTH EAST ELEVATION



NORTH ELEVATION



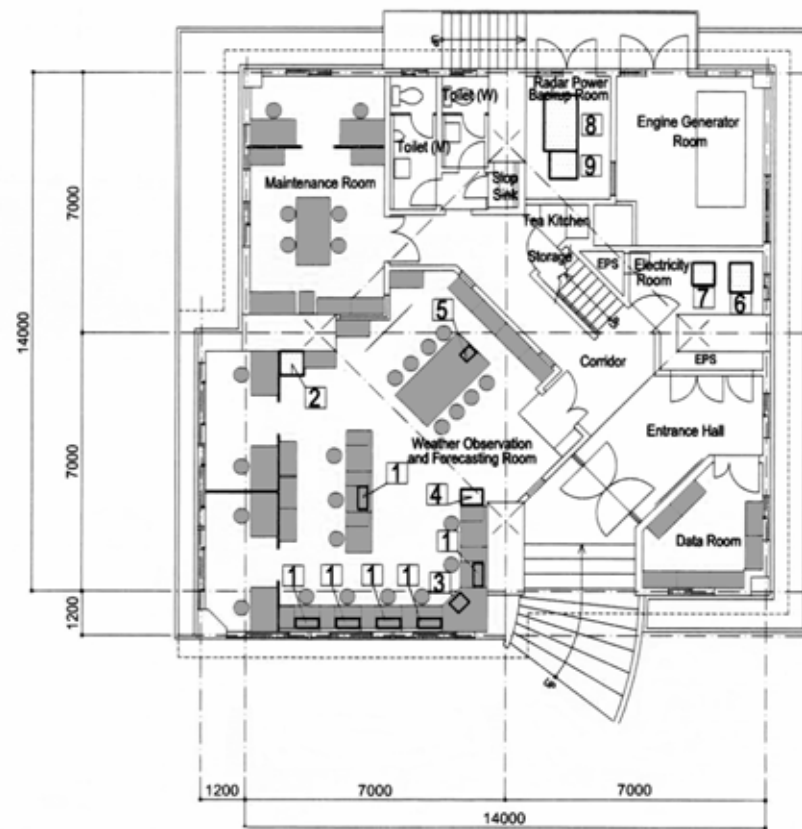
SECTION



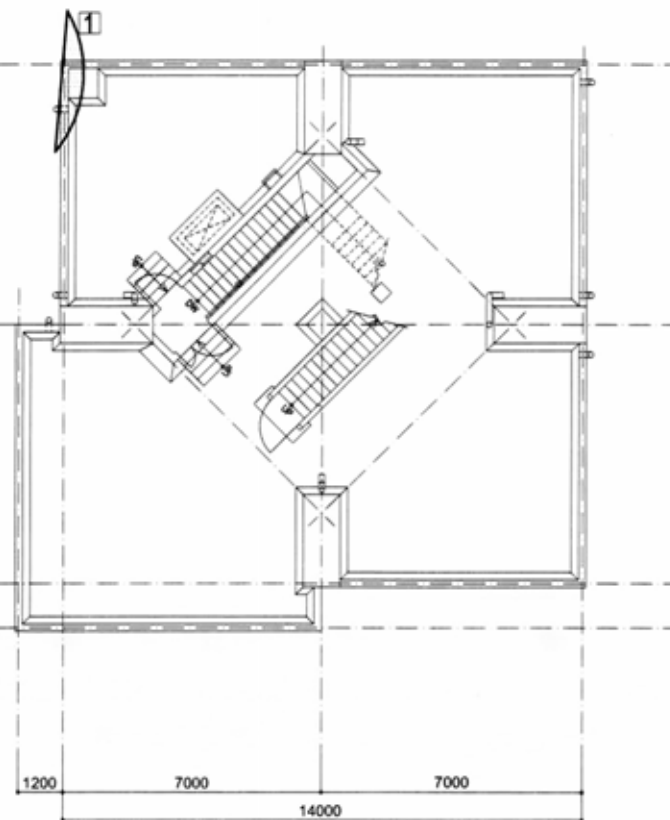
JWA Japan Weather Association
 Sunshine 60 Bldg., 65F, 3-1-1, Higashi Ikebukuro, Toshima-ku, Tokyo,
 170-6065 Japan Tel. +81-3-5968-8101 Fax. +81-3-5968-8102

RADAR TOWER BUILDING

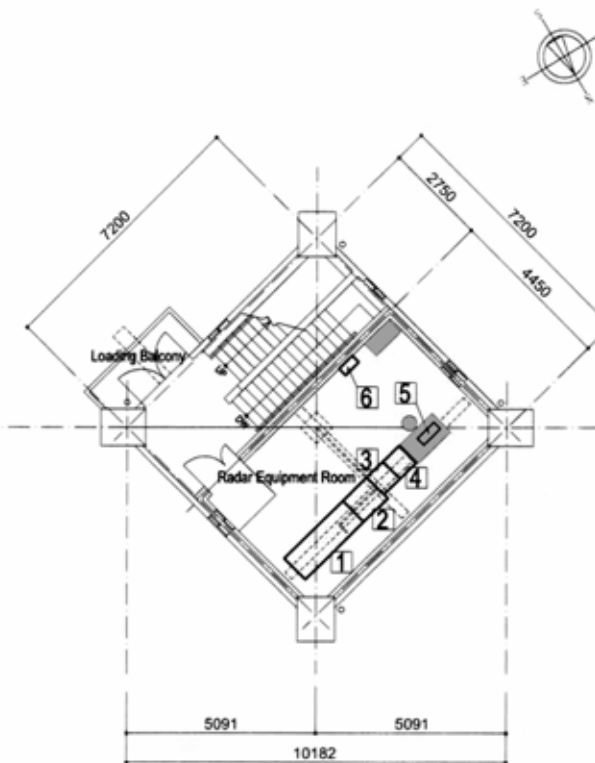
DRAWING TITLE	SCALE	DRAWING No.
ELEVATION / SECTION	1:200	A - 04



1F PLAN



2F PLAN

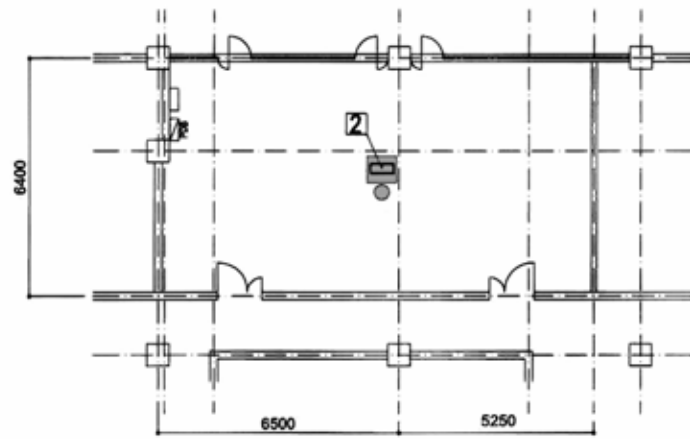


6F PLAN

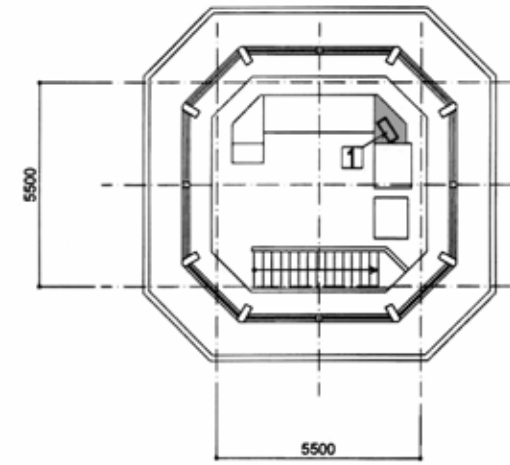
- ① Display Terminal
- ② Satellite Receiver Unit
- ③ Color Printer
- ④ Copy Machine
- ⑤ Projector
- ⑥ Radar AVR
- ⑦ Radar Isolation Transformer
- ⑧ Radar Power Backup Unit
- ⑨ Radar Power Backup Unit Control Panel
- Furniture

- ① Satellite Antenna

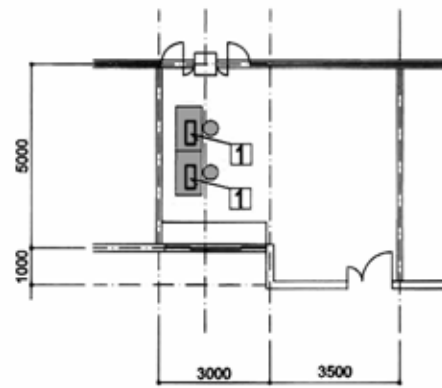
- ① TX Unit
- ② AMPLIFIER TUBE UNIT
- ③ DRSP
- ④ ANT CONT
- ⑤ Display Terminal
- ⑥ Radar Power Maintenance Box
- Furniture



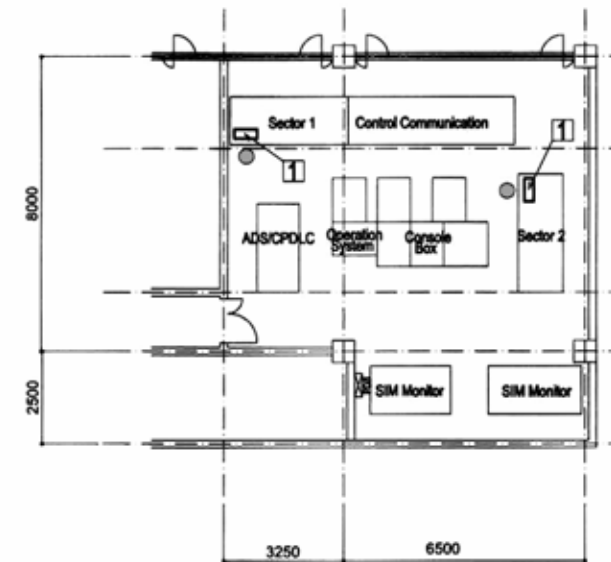
EQUIPMENT ROOM



FLIGHT CONTROL ROOM



METEOROLOGICAL OFFICE



AREA CONTROL CENTER

- ① Display Terminal
- ② HUB, Router
- Furniture

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The coordination among related implementation works for the completion of the Project will be necessary, because the Project concerns systematically many fields such as procurement and installation of meteorological and communication equipment, construction work, etc. Since the period between May and September in Laos is the rainy season (especially in August, the largest amount of rainfall and occurrence of many hazardous floods have been recorded) and manufacturing of meteorological equipment takes time, management of implementation time schedule should be given particular attention.

1) Executing agency of the Project

The responsible governmental agency of Laos for the implementation of the Project is DMH under supervision of the Ministry of Agriculture and Forestry and it will be a signer of Consultant Agreement and Contract as the Client.

2) Consultant

After signing of the Exchange of Notes (E/N) for the Project between the Government of Lao P.D.R and the Government of Japan, it is very significant to conclude an Agreement of the Consulting Services for the Project as early as possible. The Agreement of the Consulting Services will be signed by and between DMH and a consulting firm duly organized and existing under the laws of Japan, having its principal office in Japan and recommended by JICA.

A consulting firm will be the Consultant for the Project by signing of the Agreement. Then, the Consultant will conduct a detailed design study in Laos with DMH and in Japan, and prepare tender documents including technical specifications, drawings, diagrams, etc. In addition, the Consultant will conduct a tendering and supervise the Project implementation for successful completion of the Project as a project of Japan's Grant Aid Assistance.

3) Contractor

A contractor (an equipment supplier and a construction company) duly organized and existing under the laws of Japan, having its principal office in Japan, with necessary qualifications, will be selected by an open public tender in accordance with the tender documents prepared by the Consultant in accordance with the JICA guideline and approved by DMH.

4) Local Sub-contractors

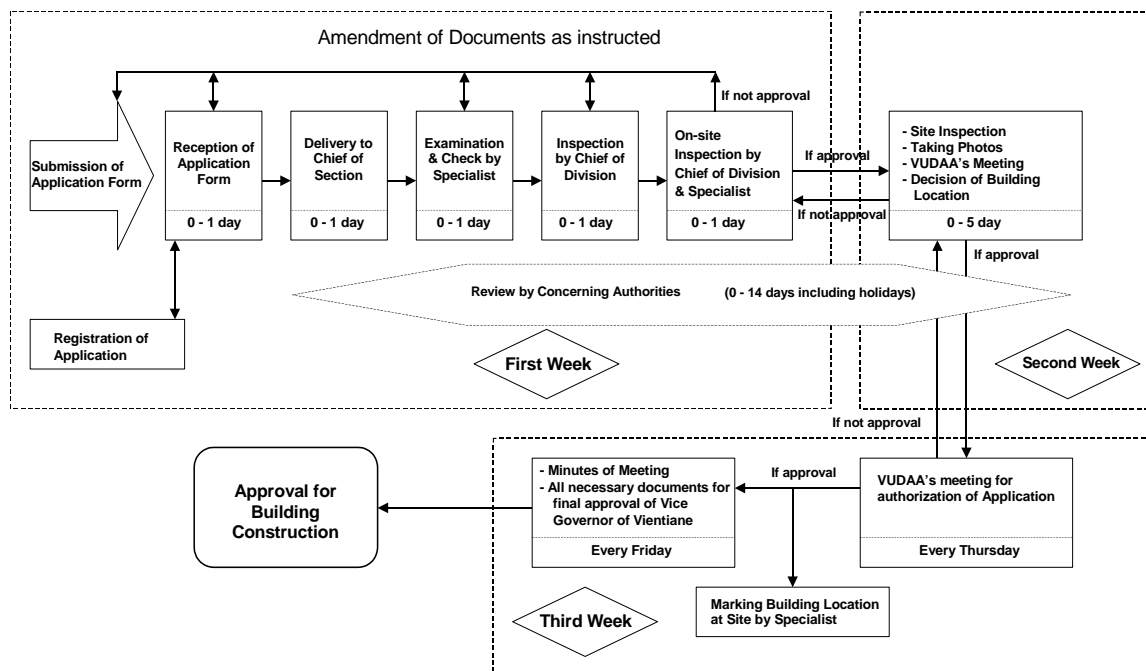
Local firms may participate in the Project as sub-contractors working together with engineer(s) of the Contractor for construction of the radar tower building and installation of the planned equipment. A local sub-contractor must be not responsible for the whole or the main part of the work.

2-2-4-2 Implementation Condition

1) Building Construction Permission

For obtaining a construction permission for the radar tower building, submission of the application to the VUDAA is required because the radar tower building is not classified as a large scale building. The all necessary procedures for the construction permission in VUDAA takes for 3 or 4 weeks, and then the permission is finally approved by the Vice Governor of Vientiane. For process of the construction permission for the radar tower building, the agreement signed by and between DMH and DCA must be attached to the application form as per a request of VUDAA. Prior to commencement of construction of the radar tower building, DMH shall obtain the permission at his responsibility as one of the most significant obligations to be taken by DMH.

Flow Chart of All Procedures for Approval for Building Construction



2) Equipment Installation Condition

The meteorological radar system, the computing equipment and the other sophisticated equipment with electric and electronic circuits will be installed in the radar tower building to be constructed. Thus, electrical power supply and power back-up equipment (engine generator system, AVR, radar backup unit, etc.) are indispensable for uninterrupted operation of these equipment. In accordance with the construction schedule, a dispatch of an electrical engineer is required at the time of the installation, adjustment and wiring for the electrical power supply and power back-up equipment and also a building equipment engineer is required for adjustment and confirmation of air-conditioning performance at the time of the installation of air-conditioning systems. During the construction period, smooth procurement of required materials and securing of the skilled laborers according to the construction schedule are important. In addition to these dispatch mentioned above, specialized high skilled engineers for installation, adjustment and commissioning works of the radar system, the computing equipment and the sophisticated meteorological equipment are indispensable for keeping high precision and quality of the installation work necessary for accurate meteorological observation. Furthermore, as technology transfer to the staff of DMH, specialized high skilled engineers are also required for on-the-job training in view of appropriate and efficient operation and maintenance of all the equipment by DMH.

2-2-4-3 Scope of Works

Scope of works to be undertaken by the Japan's Grant Aid Assistance and the Laos side for the implementation of the Project are as follows.

1) Construction of the Radar Tower Building

<Scope of works to be undertaken by the Japan's Grant Aid Assistance>

- a) Architectural and civil works
- b) Electrical works
- c) Air-conditioning and Ventilation works
- d) Plumbing works

<Scope of works to be undertaken by the Laos side>

- a) Securing necessary permission for construction of the radar tower building
- b) Securing the Project site
- c) Movement and relocation of any obstruction in the Project site, if required

- d) External and planting work, if necessary
- e) Fencing work, if required
- f) Access roads work, if required
- g) Power supply intake work
- h) Water intake work
- i) Telephone line intake work
- j) Purchase of furniture, if required

2) Installation Work for the Equipment

<Scope of works to be undertaken by the Japan's Grant Aid Assistance>

- a) Procurement of the required equipment
- b) Transport of the equipment to the Project site
- c) Installation work for the equipment
- d) Adjustment work for the equipment
- e) Commissioning for the total system

<Scope of works to be undertaken by the Laos side>

- a) Provision of stable commercial power supply at the Project site
- b) Provision of the public telephone lines at the Project sites
- c) Obtaining necessary frequencies for the radar system and the data communication system
- d) Shifting and removing any obstructions in the Project site
- e) Necessary measures against any damage and disappearance for the equipment & systems

2-2-4-4 Consultant Supervision

1) Principal Guidelines

- a) To take a responsibility for expeditious project implementation and supervision for the Project in accordance with the guidelines of Japan's Grant Aid Assistance and the basic design.
- b) To communicate closely with responsible organizations and personnel of both countries, and complete the Project in time in accordance with the implementation schedule.
- c) To provide appropriate advise to personnel of DMH and the contractor.

- d) To provide instructions for construction and installation methods and technique to the DMH's staff and local contractors as technology transfer so as to maximize the project effect.

2) Consultant Supervision

- a) The Consultant will dispatch at least one responsible personnel to Laos at each implementation stage in the Project.
- b) With respect to installation and adjustment works of the equipment, data communication equipment, computing equipment and system software, specialized engineers of the Consultant are necessary to dispatch to Laos for timely installation guidance, inspection, etc. for each equipment.
- c) The Consultant will attend performance test at a factory, adjustment, inspection for the equipment instead of DMH.
- d) For data transmission test in Laos, required engineer(s) will be dispatched.

3) Scope of Work for Supervision

- a) The Consultant in coordination with DMH will prepare the form of the contract in accordance with JICA standard and select a Japanese prime contractor through tendering, and also recommend the nominated contractor to the Government of Lao P.D.R.
- b) The Consultant will inspect and confirm shop-drawings, system drawings & diagrams and material samples submitted by a contractor as well as performance and function of all the equipment.
- c) Based on a review of the implementation schedule, the Consultant will provide instructions to a contractor and submit progress reports on the implementation of the Project to DMH, Embassy of Japan, JICA local office, etc.
- d) The Consultant will cooperate in certification of payment, such as through examination of notice of approval and invoices in connection with implementation cost to be disbursed during the implementation period and upon completion of the Project.
- e) As required during the implementation period, the Consultant will perform inspections at each stage of the work based on confirmation of completion and fulfillment of the contract conditions. The Consultant will be present at the handing over of the equipment, at which point its tasks will be completed, with the approval of DMH. Reports will also be made to concerned personnel in the Government of Japan on all required items, such as progress reports during the implementation

period, payment procedures, completion and handing over.

2-2-4-5 Quality Control Plan

Due to high temperature, high humidity, strong solar radiation and concentrated rainfall during the rainy season from May to September, proper quality control is required in regard to the construction work. According to past local meteorological data, the daytime temperature can reach more than 35°C in March and April, necessitating measures to deal with a possible concrete temperature of more than 30°C. In view of such likelihood, the ambient temperature at the time of concrete placing and the concrete temperature will be measured to ensure the correct concrete quality. There is one batcher plant approximately 30 minutes away from the Project site by car. For the Project, fresh concrete will be transportable from the plant.

The quality control plan for the main work is described in the table below.

Quality Control Plan

Work	Work Type	Control Item	Method	Remarks
Structural Work	Concrete work	Fresh concrete Concrete strength	Slump, air volume, temperature Comprehensive strength test	Strength test at a public test institution
	Reinforcing work	Reinforcing bar Arrangement	Tensile test, mill sheet check Bar arrangement check	
	Pile work	Material, bearing capacity	Bearing capacity check	
Finishing Work	Roof work	Workmanship, leakage	Visual inspection, water spray test	
	Tile work	Workmanship	Visual inspection	
	Plastering work	Workmanship	Visual inspection	
	Door & window work	Products, Installation accuracy	Factory inspection sheet check Visual inspection, dimension check	
	Painting work	Workmanship	Visual inspection	
	Interior work	Products, workmanship	Visual inspection	
Electrical Work	Power Receiving & Transforming	Performance, operation installation check	Factory inspection sheet check; withstand voltage, megar, operation, visual inspection	
	Conduit work	Bending, support check	Visual inspection, dimension	
	Wiring and cable work	Sheath damage, loose connection check	Performance sheet check, cleaning before laying, marking after bolt fixing	
	Lightning work	Resistance, conductor support pitch check	Resistance measuring, visual inspection, dimension	
	Lighting work	Performance, operation, installation check	Performance sheet check, illumination measurement, visual inspection	
Mechanical Work	Water Piping Work	Support pitch, leakage	Visual inspection, leakage, water pressure test	
	Pump Installation	Performance, operation installation check	Performance sheet check, flow rate test	
	Air-Con. work	Performance, operation installation check	Performance sheet check, temperature measurement	
	Sanitary Fixture	Operation, installation, leakage check	Visual inspection, flow test	

2-2-4-6 Procurement Plan

(1) Equipment Procurement

1) Equipment Procurement Policy

The most considerable factors in supplying the equipment are maintenance method and availability of the necessary parts and consumables in Laos. The equipment procurement must take account of ongoing maintenance requirements after the completion of the Project. None of the meteorological equipment to be supplied under the Project is being produced in Laos. All things about high reliability, durability, accuracy and performance of the meteorological radar system with the related equipment considered, the most recommendable system is Japanese one.

The most important areas concerned with supply of the systems involve operation & maintenance methods and also procurement of necessary spare parts long after the completion of the Project. This will surely be a vital factor in determining the success of the Project. The activities of the private sector in Laos will be useful for the computer systems and other sophisticated systems. There are many computing equipment manufactures. The procurement plan for the equipment is designed with a view to achieving the maximum possible degree of standardization as well as ease of obtaining spare parts and maintenance service in selecting computing equipment.

2) Equipment Procurement Plan

Equipment procurement plan for the Project is classified as follows.

Name of Equipment	Procurement Plan		
	Japan	Laos	Third Countries
Meteorological Doppler Radar System	○		
Meteorological Satellite Data Receiving System	○		○
Meteorological Data Communication System	○		
Meteorological Radar Data Display System	○		
Meteorological Satellite Data Display System	○		○
Furniture for the equipment		○	

(2) Procurement of Construction Work Material

1) Procurement Policy of Construction Work Material

As the main construction materials can be procured locally, they will, in principle, be

procured in Laos. However, the products actually produced in Laos are limited to gravel, sand, fresh concrete, some secondary concrete products (blocks, floor materials, etc.) and timber for temporary works, etc. Other construction materials imported from Thailand are marketed throughout Laos. As these imported materials from Thailand can be easily procured locally, they are considered part of the procurement of local products. Because of the easy maintenance of the radar tower building, materials locally available will be actively utilized.

2) Procurement Plan of Construction Work Material

[1] Structural Work

The main materials for the structural work, such as fresh concrete, plywood for form works, etc., can be procured locally, including products imported from Thailand. Local made concrete block is available and is a common material for a building construction.

[2] Building Exterior and Interior Work

Timber, tiles, paint, glass aluminum window frame, etc. used for the exterior and interior of a building are imported from Thailand and are readily available in the local market in principle.

[3] Air-Conditioning and Plumbing Work

Air-conditioning equipment, exhaust fan, various apparatus, sanitary-fixture, etc. are popular in Laos. In principle, those products is procured in the local market in view of easy repair and maintenance.

[4] Electrical Work

Lighting fixtures made in Thailand, switches, lamps, electrical wires and cables, conduits and others are available in the local market, they will, in principle, be procured in Laos in view of easy repair and maintenance.

Major Materials Procurement Plan

Architectural Work

Materials	Local Market		Procurement Plan		
	Condition*	Import	Laos	Thai	Japan
Portland cement			√		
Sand, aggregate			√		
Reinforcing bar			√		
Form (plywood)		Thai	√		
Concrete block					
Asphalt waterproofing		Thai	√		
Ceramic tile		Thai	√		
Wood					
Aluminum door & window		Thai, ASEAN	√		
Steel door & window		Thai, ASEAN	√		
Wooden door & window		Thai	√		
Door handle, lock		Thai	√		
Plane glass		Thai	√		
Paint		Thai	√		
Gypsum board (T-bar)		Thai	√		
Rockwool acoustic board (T-bar)		Thai	√		
Carpet tile		Thai	√		
PVC tile		Thai	√		

Mechanical and Electrical Work

Work type	Materials	Local Market		Procurement Plan		
		Condition*	Import	Laos	Thai	Japan
Air-conditioning work	Air conditioner		Thai, Japan	√		
	Exhaust fan		Thai, Japan	√		
Plumbing work	Sanitary fixture		Thai	√		
	Pipe		Thai	√		
Electrical work	Lighting fixture		Thai	√		
	Panel		Thai, Japan	√		
	Wire, cable		Thai	√		
	Conduit (PVC)		Thai	√		
	Telephone system		Thai, Korea	√		
	Fire alarm system		Thai	√		

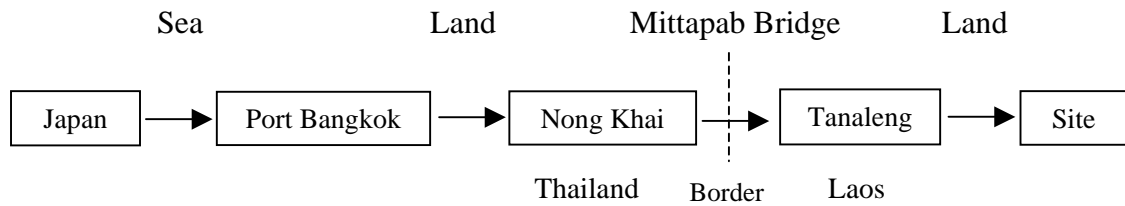
* : Easy to procure in Laos

: Available in the local market in Laos but model and quantity are limited

X: Difficult to procure in Laos

3) Transportation Plan

In principle, transportation of the equipment from outside of Laos will use wooden crates or container shipment. The main disembarkation point for maritime cargo to Laos is the Bangkok Port in Thailand. All cargos will be transported to a bonded warehouse in Tanaleng in Laos from Nong Khai via the Mittapab Bridge over Mekong River for the following customs clearance. After the customs clearance, it will be delivered to the site by a Laotian transporter. The tax exemption procedure must be cleared by Laos side in advance.



The equipment from outside of Laos, transportation of the equipment from an actual shipment to the site including the custom clearance, normally it takes 1 month. After a vessel leaves from a port, all the documents concerned with the shipment will be sent to Bangkok and Vientiane for the required local procedures. A cargo disembarked at the Bangkok Port will be stored in the transit warehouse until a permission of the Laos tax exemption has been issued by the Government of Lao P.D.R. Approximately 10 days will be required to take the permission. For obtaining the permission, supporting letters form DMH and the Ministry of Agriculture and Forestry attached with invoice, packing list and ocean bill will be submitted to the following agencies in the Government of Lao P.D.R. It takes about between 3 and 4 weeks.

- a) FIMC (Foreign Investment & Management Committee)
- b) Ministry of Commerce
- c) Ministry of Finance
- d) Department of Commerce
- e) Department of Customs
- f) Tax Department
- g) Thanaleng Customs House

2-2-4-7 Implementation Schedule

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Detailed Design																					
Tendering Procedure																					
Construction Work																					
Equipment Manufacturing																					
Transportation																					
Equipment Installation / Adjustment																					
Completion																					△

2-3 Obligation of Recipient Country

In the implementation of the Project under Japan's Grant Aid Assistance, DMH is required to undertake the following necessary measures.

- 1) General requirements
 - a) To take all necessary institutional and juridical procedures in Laos.
 - b) To exempt taxes and to take necessary measures for customs clearance of the materials and equipment brought for the Project at the port of disembarkation.
 - c) To accord Japanese nationals whose services may be required in connection with the supply of products and the services under the verified contracts such facilities as may be necessary for their entry into Laos and stay therein for the performance of their work.
 - d) To provide necessary spaces at DMH Head Office for the Consultant and the Contractor for the implementation of the Project, if required.
 - e) To allocate necessary personnel for meteorological observation and forecasting works.

- 2) Requirements for the Equipment
 - a) To remove and relocate the existing facilities for installation of the equipment, if required, at the expense of DMH.
 - b) To provide appropriate frequencies for the meteorological radar system and the meteorological data communication system to be installed.
 - c) To secure effective spaces at the existing facilities for installation of the equipment to be supplied.

- d) To provide suitable existing telephone links and interfaces for establishing systems.
 - e) To maintain and properly and effectively utilize the equipment purchased under the Grant Aid.
- 3) Requirements for Construction of Radar Tower Building
- a) To obtain necessary permissions for construction of the radar tower building.
 - b) To secure land necessary for the site of the Project and to clear, level and reclaim the land prior to commencement of the construction.
 - c) To provide facilities for distribution of electricity, water supply, telephone trunk line, drainage, sewage and other incidental facilities to the Project site.
 - d) To supply general use furniture such as carpets, curtains, tables, chairs and others, if necessary.
 - e) To undertake incidental outdoor works such as gardening, fencing, gates and exterior lighting in and around the site, if necessary.
 - f) To provide temporary facilities for distribution of electricity, water supply, telephone, and other incidental facilities for the construction work.
 - g) To secure effective spaces at the Project site for temporary facilities such as a contractor's office, workshop, building materials storage, etc. for the construction work.
 - h) To maintain and properly and effectively utilize the building constructed under the Grant Aid.

2-4 Project Operation Plan

(1) Operation and Maintenance Plan for the Equipment

1) Operation Plan of Meteorological Radar System

After the completion of the Project, operation of the meteorological radar system has been planned in accordance with annual transition of the climate in Laos. Laos side has agreed with the following operation plans.

[1] Radar Operation Plan in Dry Season

I. Estimated radar observation intervals for the purpose of torrential rain monitoring

<November – March>

Observation every 3 hours due to quite low possibility of heavy rain in the dry season

Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
			■			■			■			■			■			■			■			■

II. Estimated radar observation intervals for the purpose of aircraft navigation safety according to the schedule of aircrafts

1 unit of observation is for 20 minutes consists of warming-up operation for 10 minutes and actual operation for 10 minutes.

Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
							■		■	■	■	■	■	■	■	■	■	■	■	■	■			

[2] Radar Operation Plan in Transition Period and Rainy Season

I. Estimated radar observation intervals for the purpose of torrential rain monitoring

<June and October>

Observation every hour

Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

<April, May, July and September>

Observation every half an hour due to having regional heavy rain

Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

<August>

Continuous operation for 24 hours due to having the largest amount of rainfall in a year

Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

II. Estimated radar observation intervals for the purpose of aircraft navigation safety according to the schedule of aircrafts

1 unit of observation is for 20 minutes consists of warming-up operation for 10 minutes and actual operation for 10 minutes.

Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
							■		■	■	■	■	■	■	■	■	■	■	■	■				

2) Operation and Maintenance Plan for the Equipment

In connection with equipment maintenance, consideration must be given to the following matters.

- a) Technical training for DMH staff
- b) Establishment of appropriate measures against system failure
- c) Complete control of depository of maintenance records
- d) Regular replacement of spare parts and overhauls
- e) Strengthening of maintenance structure of DMH

3) Staff Allocation for Operation and Maintenance for the Equipment

After the completion of the Project, all the equipment installed in the radar tower building will be operated and maintained by the allocated staff presently available in the Division of Meteorological Network and Agro-meteorology and the Division of Weather Forecasting

in DMH according to the following planned weekly shift time schedule.

Weekly Time Schedule of Duty in DMH

	Monday		Tuesday		Wednesday		Thursday	
	07:00	19:00	07:00	19:00	07:00	19:00	07:00	19:00
Forecasting	F1, F2 D, DD1	DD2, F3 (Support from other division during heavy rain)	F4, F5 D, DD1	F1, F2 (Support from other division during heavy rain)	DD2, F3 D, DD1	F4, F5 (Support from other division during heavy rain)	F1, F2 D, DD1	DD2, F3 (Support from other division during heavy rain)
Data Communication	C1	C2	C3	C1	C2	C3	C1	C2
Observation	O1	O2	O3	O1	O2	O3	O1	O2
Aeronautical	A1	A2	A3	A1	A2	A3	A1	A2
Radar Operation, System Administration and Maintenance	E1, E2, T1, T2	T3, T4	E1, E2, T5, T6	T1, T2	E1, E2, T3, T4	T5, T6	E1, E2, T1, T2	T3, T4

	Friday		Saturday		Sunday	
	07:00	19:00	07:00	19:00	07:00	19:00
Forecasting	F4, F5 D, DD1	F1, F2 (Support from other division during heavy rain)	DD2, F3 (Support from other division during heavy rain)	F4, F5 (Support from other division during heavy rain)	F1, F2 (Support from other division during heavy rain)	DD2, F3 (Support from other division during heavy rain)
Data Communication	C3	C1	C2	C3	C1	C2
Observation	O3	O1	O2	O3	O1	O2
Aeronautical	A3	A1	A2	A3	A1	A2
Radar Operation, System Administration and Maintenance	E2, T5, T6	T1, T2	E2, T3, T4	T5, T6	E1, T1, T2	T3, T4

Weather Forecasting and Aeronautical Meteorology Division (WFAMD)

- D: Director
- DD1, DD2: Deputy Director
- F1 - F5: Forecasters
- A1 - A3: Aeronautical Meteorologists

Meteorological Network and Agro-meteorology Division (MNAD)

- C1-C3: Data Communication Technicians
- O1 - O3: Observers
- E1, E2: Engineer
- T1-T6: Technician

(2) Operation and Maintenance Plan for the Radar Tower Building

There are three key issues for the maintenance of the radar tower building, i.e. (i) daily cleaning, (ii) repairs in the face of wear, damage or aging and (iii) security to ensure safety and crime prevention.

The rigorous implementation of daily cleaning for the building gives a good impression to visitors/users and prompts people to gently use the building and the equipment. It is also important to keep the proper functions of the equipment, to lead the early detection and repair of any damage and also to prolong the life of the building equipment.

The main components of the repair work will be repair or replacement of exterior and interior materials protecting the building structure. The required inspections are outlined below.

<Outline of Regular Inspection for the building>

	Items of Maintenance Work	Frequency
Exterior	Repair and repainting of external walls	Repair: every 5 years, Repaint: every 15 years
	Inspection and repair of roofs	Inspection: every year Repair: as required
	Regular cleaning of drain pipes and drainage system	Monthly
	Inspection and repair of sealing of external windows and doors	Every year
	Regular inspection and cleaning of ditches and manholes	Every year
Interior	Renewal of interior finishing	As required
	Repair and repainting of partition walls	As required
	Adjustment of window and door fitting	Every year

What is very significant for the building equipment is regular preventive maintenance before the building equipment gets out of order which requires repair or replacement of part(s). The life of the building equipment can certainly be extended by proper operation and regular inspection, lubrication, adjustment and cleaning. Such regular inspection can prevent the equipment stoppage and accidents. With regular inspection, replacement of consumables and cleaning/replacement of filters for ventilations and air-conditioning units should be implemented in accordance with the maintenance manual.

It is essential to establish a proper maintenance structure in DMH involving the rigorous implementation of regular inspection and maintenance and to consign such works to the private sector (local agents), if required. The general life expectancy of the major building equipment is shown below.

<Life Expectancy of Building Equipment>

System	Building Equipment	Life Expectancy
Electrical System	• Distribution panels	20 – 30 years
	• Fluorescent lamps	5,000 – 10,000 hours
	• Incandescent lamps	1,000 – 1,500 hours
Water Supply and Drainage Systems	• Pipes and valves	15 years
	• Sanitary fixture	25 – 30 years
Air-Conditioning System	• Pipes	15 years
	• Exhaust fans	20 years
	• Air-conditioning units	15 years

2-5 Project Cost Estimate

2-5-1 Estimate of Project Cost and Capital Cost to borne by DMH

The Project cost to be financed by the Japan's Grant Aid Assistance and the required capital cost for the Project to be borne by DMH have been estimated as follows. However, the following Project cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

<Project Cost Estimate>

Items		Estimate (JP Yen)	
Equipment	Meteorological Radar System	JPY 503 Million	JPY 657 Million
	Meteorological S Satellite Data Receiving system		
	Meteorological Data Communication System		
	Meteorological Radar and Meteorological Data Display System		
Construction	Radar Tower Building	JPY 154 Million	
Consulting Services (Detailed Design, Supervision, Technical Guidance, etc.)		JPY 82 Million	
Total		JPY 739 Million	

<Capital Cost of DMH>

Items	Capital Cost (Laos Kip)
Removal of the existing facility at the construction site in DMH	5,000,000 kip
Electricity laid down cost	38,000,000 kip
Telephone line laid down cost for 2 lines	2,900,000 kip
Water supply pipe laid down cost and connection work at a gate valve	2,000,000 kip
Total	47,900,000 kip

2-5-2 Estimate of Recurrent Cost for the Project to borne by Laos side

(1) Recurrent Cost to be borne by DMH and DCA

In case that the Project has been financed by the Japan's Grant Aid Assistance, the annual recurrent costs to be borne by DMH and DCA for the first decade after the completion of the Project and are attached hereunder. The recurrent cost has been calculated in accordance with the following fundamental conditions.

- Operation and maintenance to be implemented by DMH and DCA
- Appropriate operation in accordance with the operation manuals
- Regular and proper maintenance according to the maintenance manuals

Since all the equipment to be supplied under the Project has been designed to install in the radar tower building to be constructed in the premises of DMH Head Office and the control tower building in Vientiane International Airport, the recurrent cost which consists of operation and maintenance costs of the equipment and the radar tower building to be shared by DMH and DCA has separately been calculated hereto.

Estimated Recurrent Cost of the Project

<to be borne by DMH >

- Spare Parts and Consumables

Equipment	Item	Q'ty	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9 year	10 year	Remarks
1. Antenna	Grease	1	18,000 kip	18,000 kip	18,000 kip	18,000 kip	18,000 kip	18,000 kip	18,000 kip	18,000 kip	18,000 kip	18,000 kip	1kg/can, every year
	Timing belt	2	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$95.24	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$95.24	
2. Transmitter/Receiver	Timer relay for pre-heating	1	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$19.05	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$19.05	
	Blower unit	2	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$42.86	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$42.86	
	AC fan	2	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$39.05	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$39.05	
	Fuse for the power supply unit	2	US\$0.00	US\$0.00	US\$0.00	US\$9.52	US\$0.00	US\$0.00	US\$0.00	US\$9.52	US\$0.00	US\$0.00	
3. Antenna controller	Lamp for operation panel	1	US\$0.00	US\$0.00	US\$0.00	US\$9.52	US\$0.00	US\$0.00	US\$0.00	US\$9.52	US\$0.00	US\$0.00	
	Fuse for the power supply unit	1	US\$0.00	US\$0.00	US\$0.00	US\$6.67	US\$0.00	US\$0.00	US\$0.00	US\$6.67	US\$0.00	US\$0.00	
	Lamp for servo amplifier system	1	US\$0.00	US\$0.00	US\$0.00	US\$9.52	US\$0.00	US\$0.00	US\$0.00	US\$9.52	US\$0.00	US\$0.00	
4. Product Monitor	Hard disk	1	US\$0.00	US\$0.00	US\$0.00	US\$150.00	US\$0.00	US\$0.00	US\$0.00	US\$150.00	US\$0.00	US\$0.00	Every 4 years
	Media for archiving product data *1	20	100,000 kip	100,000 kip	100,000 kip	100,000 kip	100,000 kip	100,000 kip	100,000 kip	100,000 kip	100,000 kip	100,000 kip	
	Printer Ink (1 set)	2	US\$144.00	US\$144.00	US\$144.00	US\$144.00	US\$144.00	US\$144.00	US\$144.00	US\$144.00	US\$144.00	US\$144.00	2sets /year
5. Copy Machine	Toner	2	US\$70.00	US\$70.00	US\$70.00	US\$70.00	US\$70.00	US\$70.00	US\$70.00	US\$70.00	US\$70.00	US\$70.00	
6. Compact UPS	Battery (about 500VA)	6	US\$0.00	US\$0.00	US\$390.00	US\$0.00	US\$0.00	US\$390.00	US\$0.00	US\$0.00	US\$390.00	US\$0.00	For each PC connection
7. Radar Power Maintenance Box	Relay for remote power control	1	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$20.00	US\$0.00	US\$0.00	US\$0.00	
8. Diesel Engine Generator	Oil seal and filter	1	US\$0.00	US\$0.00	US\$19.05	US\$0.00	US\$53.33	US\$19.05	US\$0.00	US\$0.00	US\$19.05	US\$53.33	
	Battery for Engine start	1	0kip	0kip	0kip	0kip	0kip	0kip	360,000kip	0kip	0kip	0kip	
	Subtotal (kip)		118,000kip	118,000kip	118,000kip	118,000kip	118,000kip	118,000kip	478,000kip	118,000kip	118,000kip	118,000kip	
	Subtotal (US\$)		US\$214.00	US\$214.00	US\$623.05	US\$399.24	US\$463.52	US\$623.05	US\$234.00	US\$399.24	US\$623.05	US\$463.52	

*1 Various types of products of meteorological phenomena will be recorded by terminals of DMH.

- Others

Cost Item	Name of Site / Item	Q'ty	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9 year	10 year	Remarks
1. Electricity Charge	Radar Tower Building *2	1	41,979,834kip	41,979,834kip	41,979,834kip	41,979,834kip	41,979,834kip	41,979,834kip	41,979,834kip	41,979,834kip	41,979,834kip	41,979,834kip	
2. Fuel Cost	Diesel Engine Generator *3	1	1,655,050kip	1,655,050kip	1,655,050kip	1,655,050kip	1,655,050kip	1,655,050kip	1,655,050kip	1,655,050kip	1,655,050kip	1,655,050kip	
3. Communication Cost	Charges for Internet Web Hosting and Dial-up Connection	1	6,588,000kip	6,588,000kip	6,588,000kip	6,588,000kip	6,588,000kip	6,588,000kip	6,588,000kip	6,588,000kip	6,588,000kip	6,588,000kip	
	Telephone charges for warning dissemination by FAX *4	1	1,204,000kip	1,204,000kip	1,204,000kip	1,204,000kip	1,204,000kip	1,204,000kip	1,204,000kip	1,204,000kip	1,204,000kip	1,204,000kip	
4. Water Supply	Water supply charge	1	365,000kip	365,000kip	365,000kip	365,000kip	365,000kip	365,000kip	365,000kip	365,000kip	365,000kip	365,000kip	
5. Radar Tower Exterior Finish	Paint on wall	1	0kip	0kip	0kip	0kip	0kip	0kip	0kip	0kip	0kip	0kip	
	Paint on steel	1	0kip	0kip	850,000kip	0kip	0kip	0kip	0kip	0kip	850,000kip	2,610,000kip	
	Subtotal (kip)		51,791,884kip	51,791,884kip	52,641,884kip	51,791,884kip	51,791,884kip	52,641,884kip	51,791,884kip	51,791,884kip	52,641,884kip	57,011,884kip	
	Total Amount to be borne by DMH (kip)		54,049,884kip	54,049,884kip	58,990,360kip	55,902,265kip	56,545,122kip	58,990,360kip	54,609,884kip	55,902,265kip	58,990,360kip	61,765,122kip	

*2 Electricity consumption of air conditioning

Equipment Room (6.0kW) - Nov.-Mar.: 18h/day Apr.-Oct.: 24h/day Annual: (6.0kW h x 7.740h)=46.440kW h

Observation and Forecasting Room (3kW), Data Room (0.88kW) - Annual: (3.88kW h x 8.760h)=33.988.8kW h

Maintenance Room (1.36kW) - operated during rainy season (7 months): (1.36kW h x 5.040h)=6854.4kW h

*3 Estimated annual operating hour of Diesel Engine Generator

Expected annual power storage around the DMH Head Office in Vientiane: 20 min. x 10 times/year = approx. 3.4 hours

During occurrence time of thundercloud, Diesel Engine Generator supplies power to the Radar System since the commercial power supply is instable.

Number of days thunderclouds occurred a year: approx. 60 days 1-3 hours/day x 60 days = around 100 hours/year

(Hourly Power consumption of the Radar System: 1.676kW h x 100 hours = 1,676kW h)

Estimate of Annual Fuel Cost for Diesel Engine Generator

Fuel consumption: approx. 0.25L/kW h

1.676kW h (expected annual production of electricity by the generator) x 0.25L = 419L (annual fuel consumption) 419L x 3.950K ip/L = 1,655.050K ip

*4 Telephone charges for warning dissemination by FAX

5 times/day x 28days x 5 minutes x 8 users x 215kip = 1,204,000kip

<to be borne by DCA >

- Spare Parts and Consumables

1.	Product Monitor	2	US\$144.00	US\$144.00	US\$144.00	US\$144.00	US\$144.00	US\$144.00	US\$144.00	US\$144.00	US\$144.00	US\$144.00	2 sets /year
	Printer Ink (1 set)	1	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	Every 4 years
	Hard disk	1	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	US\$0.00	For each PC connection
2.	Compact UPS	5	US\$0.00	US\$325.00	US\$0.00	US\$325.00	US\$0.00	US\$325.00	US\$0.00	US\$325.00	US\$0.00	US\$325.00	
Subtotal (US\$)			US\$144.00	US\$469.00	US\$294.00	US\$144.00	US\$469.00	US\$144.00	US\$294.00	US\$469.00	US\$144.00	US\$469.00	

- Others

1.	Electricity Charge												
	Control Center	1	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip
	Area Control Center	1	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip
	Metereological Office	1	1,548,768kip	1,548,768kip	1,548,768kip	1,548,768kip	1,548,768kip	1,548,768kip	1,548,768kip	1,548,768kip	1,548,768kip	1,548,768kip	1,548,768kip
	Equipment Room	1	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip	774,384kip
Subtotal (kip)			3,871,920kip	3,871,920kip	3,871,920kip	3,871,920kip	3,871,920kip	3,871,920kip	3,871,920kip	3,871,920kip	3,871,920kip	3,871,920kip	3,871,920kip
Total Amount to be borne by DCA (kip)			5,311,920kip	5,311,920kip	6,811,920kip	5,311,920kip	8,561,920kip	5,311,920kip	6,811,920kip	8,561,920kip	6,811,920kip	8,561,920kip	5,311,920kip

(2) Transition and Tendency of Annual Budget of DMH

The annual budgets of DMH between 1997/98 and 2003/04 are as follows.

Budget of DMH Head Office (Unit: kip)

(1,000 kip)

Descriptions \ Year	1997/1998	1998/1999	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004
Electricity	6,300	7,050	7,544	8,550	10,000	12,002	12,000
Water Utilization	3,570	3,915	4,200	4,770	5,500	5,996	6,000
Telecommunication	8,645	9,000	9,680	10,935	122,100	12,999	13,000
Technical	107,884	208,657	327,536	336,843	349,790	454,723	455,000
Administration	33,600	36,375	40,040	45,900	51,500	54,999	55,000
Salary	47,895	130,106	170,454	172,363	198,181	227,181	230,000
Total (Actual Allocation):	207,894	395,103	559,454	579,361	737,071	767,899	771,000

From 1998/99 to 1999/00, the annual budget was considerably increased due to inflation of prices. In addition, in 2002/03, additional budget for rehabilitation of the existing facility and brush-up and installation of observation instruments was requested by DMH and then it was timely allocated. The annual budgets over the past several years satisfied more than 99% of budget amount requested by DMH.

The estimated recurrent cost (approximately 55,00,000 – 62,000,000 kip) for the Project to be borne by DMH accounts for about 7% of the annual budget of DMH.

2-6 Other Relevant Issues

(1) Securing of Annual Budget for Recurrent Cost

DMH shall annually make a request to the supervising ministry of DMH, the Ministry of Agriculture and Forestry in every August.

Coming August 2004, a request of the annual budget for 2004/05 must be made by DMH and the request must include 50,000,000 kip for the capital cost of the Project to be covered by the Counterpart Fund of the Government of Lao P.D.R. For the recurrent cost after the completion of the Project, a request must annually be made by DMH and the requested budget amount must include the annual recurrent cost in accordance with the table attached above.

To secure the necessary budgets for the Project by DMH through precious cooperation of all the governmental agencies concerned with the Project, this is the most significant point and the fundamental condition for the implementation of the Project.

(2) Urban Planning for the surrounding areas of DMH Head Office

In Vientiane city, there are two areas in which construction of a building up to 40m high is permitted. In the areas surrounding the Vientiane International Airport, a building taller than 15m high is not permitted and also the other areas in Vientiane are permitted to construct a building up to 25m high by VUDAA.

The most considerable area for the radar system is one of two areas permitted to construct a building up to 40m high, which is a bank along Mekong River approximately 5km away from the site in a crow line. In case of that the antenna center of the radar system is designed as 39.5m high and the radar system is operated from the radar beam angle of +0.5 degree, approximately 5m clearance can be secured from the top of a building 40m high.

In order to keep suitable observation environment for the radar system to be established under the Project, a special consideration of the Government of Lao P.D.R and VUDAA must be given to the urban development plan of Vientiane to prohibit any construction of a building higher than 40m within 5km in diameter from the radar tower building. As per a request of DMH, VUDAA has agreed to strictly keep and follow the present “Land Use Zone & Regulations for Construction Permit (Vientiane Master Plan 2002)” and also not to issue further construction permits for any facilities taller than 40m within a 5km-radius from the radar tower building.