JAPAN INTERNATIONAL COOPERATION AGENCY
FIJI METEOROLOGICAL SERVICE
MINISTRY OF FOREIGN AFFAIRS, TOURISM AND CIVIL AVIATION
REPUBLIC OF FIJI

BASIC DESIGN STUDY REPORT

ON

THE RPOJECT FOR UPGRADING OF METEOROLOGICAL OBSERVATION AND FORECASTING SYSTEM

IN

THE REPUBLIC OF FIJI

MAY, 1995

JAPAN WEATHER ASSOCIATION

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PREFACE

In response to a request from the Government of the Republic of Fiji, the Government of Japan decided to conduct a basic design study on the Project for Upgrading of Meteorological Observation and Forecasting System and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Fiji a study team headed by Mr. Toshinobu Kato, Grant Aid Study & Design Department and constituted by members of Japan Weather Association, from January 4 to January 28,1995.

The team held discussions with the officials concerned of the Government of Fiji, 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 Fiji 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 the Republic of Fiji for their close cooperation extended to the teams.

May 1995

Kimiaki Fujita

President

Japan International Cooperation Agency

Mr. Kimiaki Fujita

President

Japan International Cooperation Agency

Tokyo, Japan

May, 1995

Letter of Transmittal

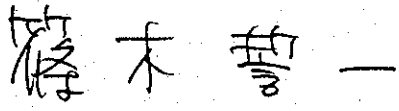
We are pleased to submit to you the basic design study report on the Project for Upgrading of Meteorological Observation and Forecasting System in the Republic of Fiji.

This study was conducted by Japan Weather Association, under a contract to JICA, during the period December 14, 1994 to May31, 1995. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Fiji 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 Fiji Meteorological Service, the Ministry of Foreign Affairs, Tourism and Civil Aviation, Ministry of Finance and Economic Development, other organizations, JICA Fiji Office and the Embassy of Japan in Fiji for their cooperation and assistance throughout our field survey.

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

Very truly yours,

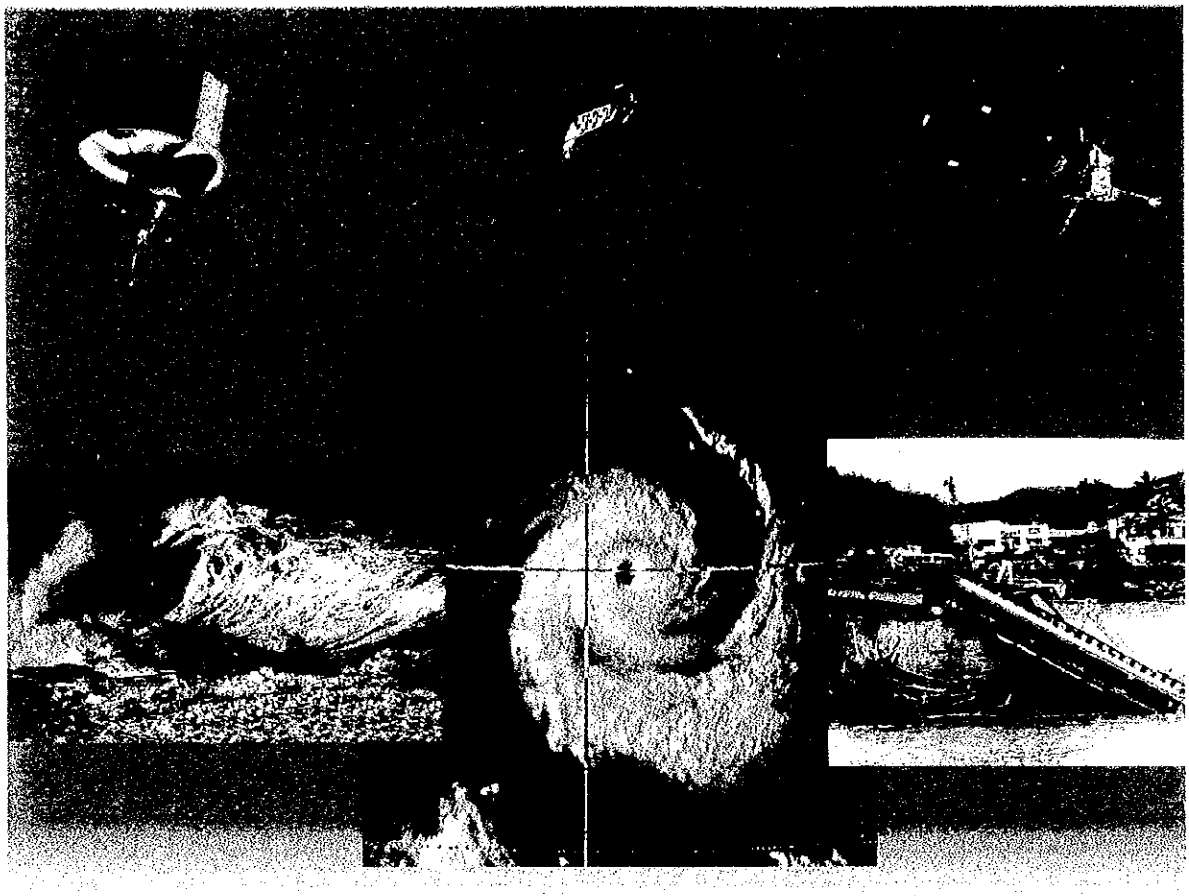


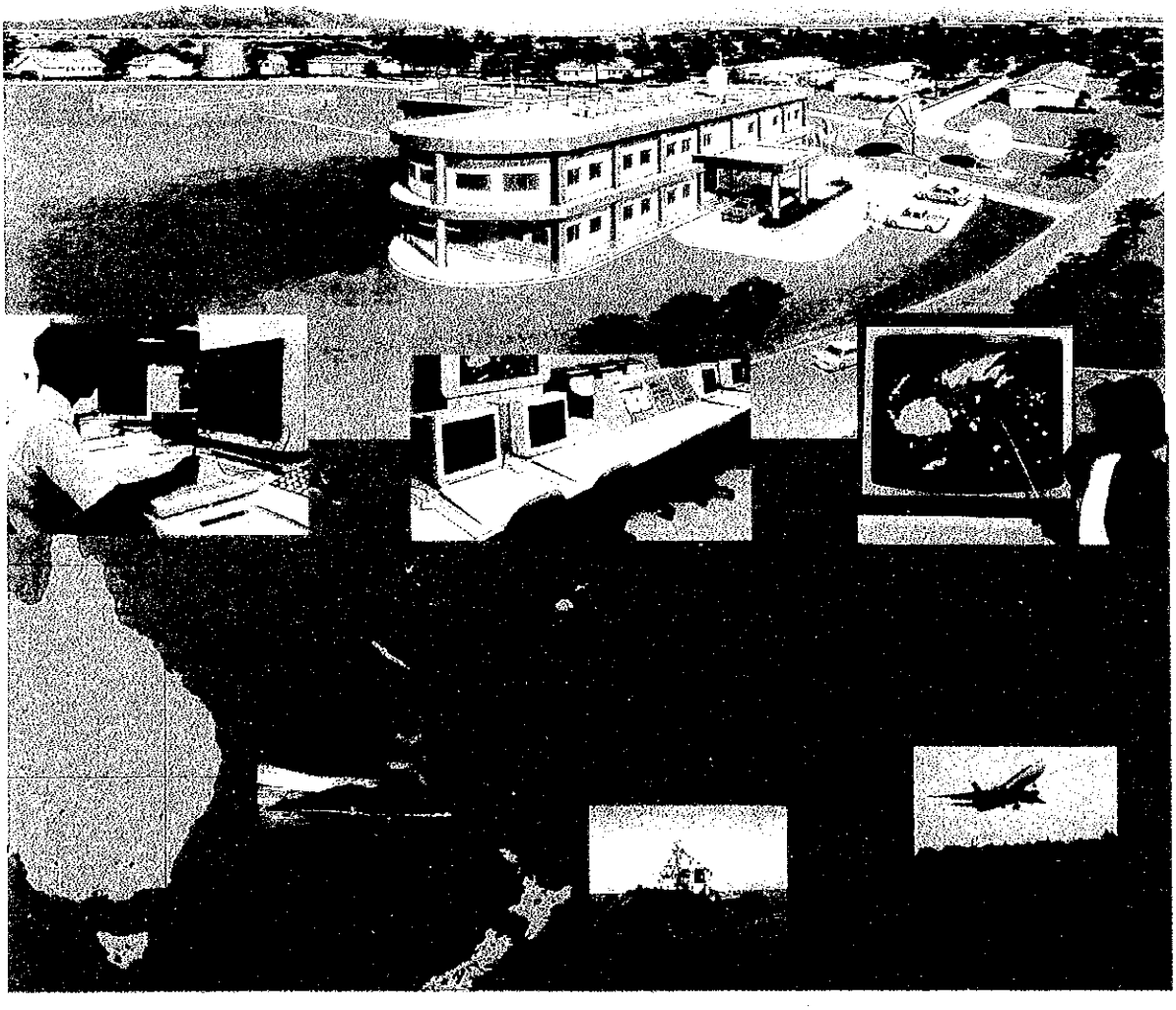
Seiichi Shinoki

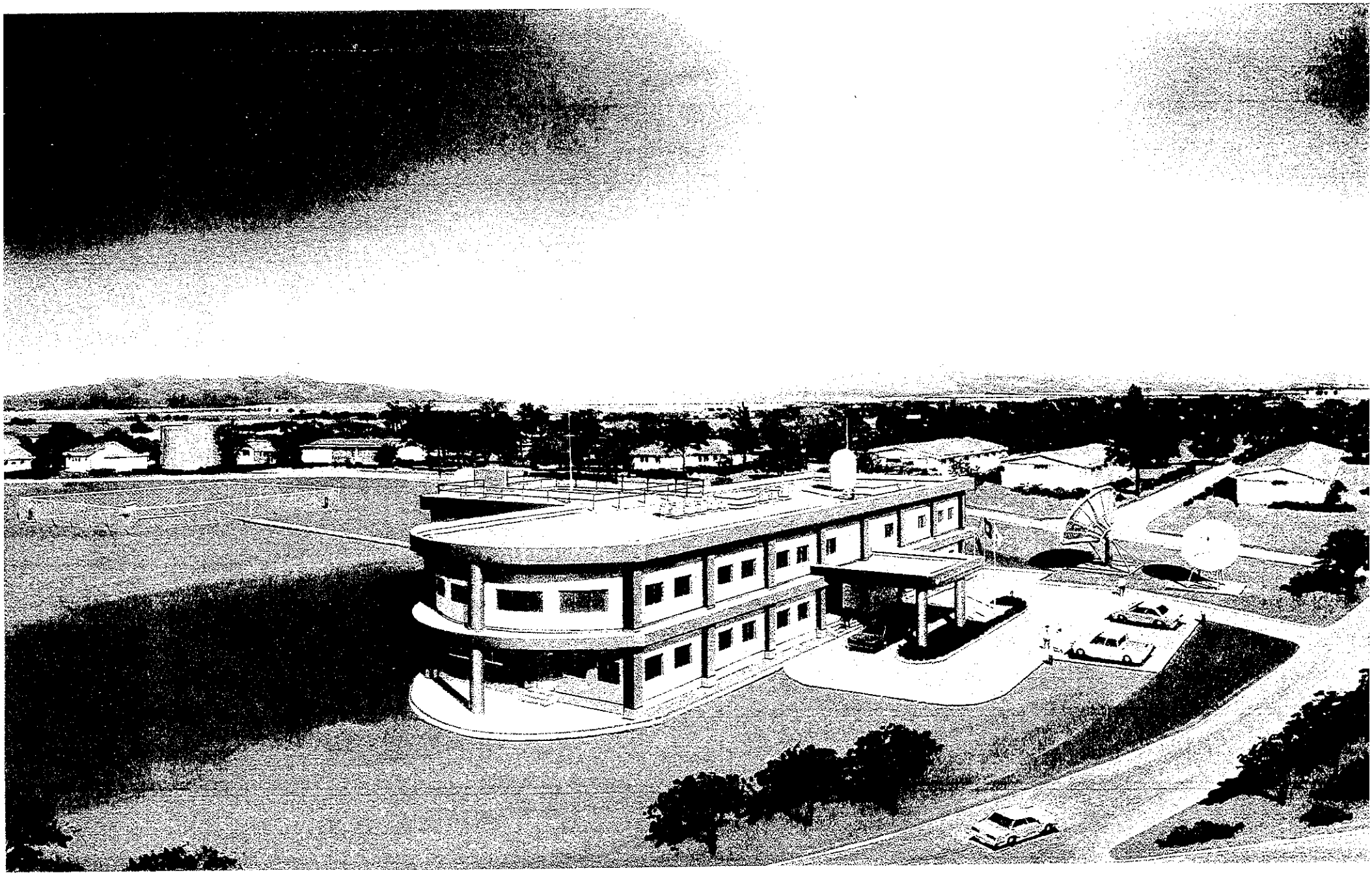
Project manager,

Basic design study team on the project for Upgrading of Meteorological Observation and Forecasting System

Japan Weather Association

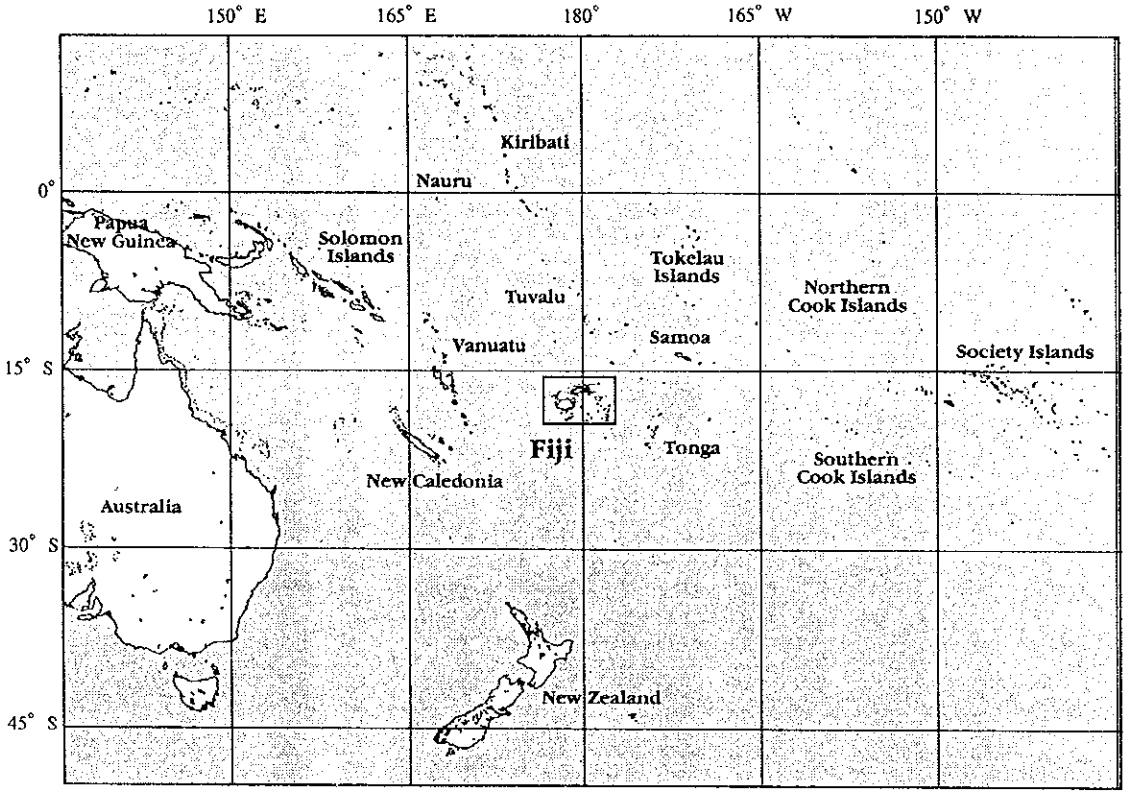




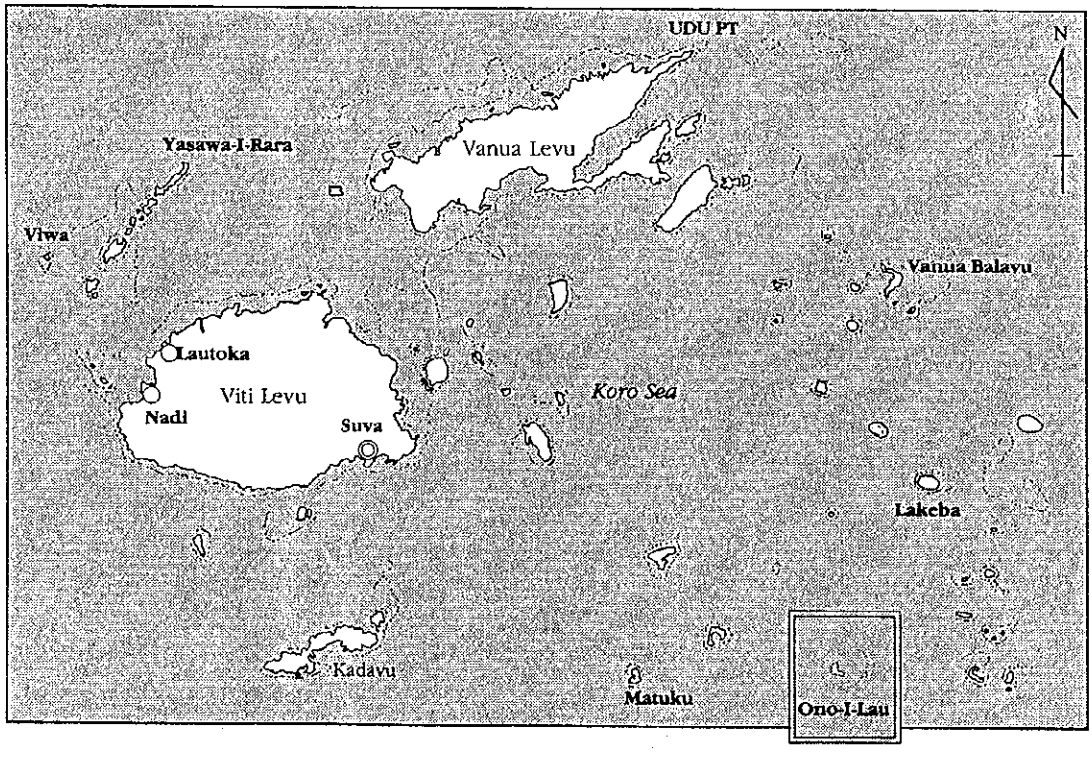


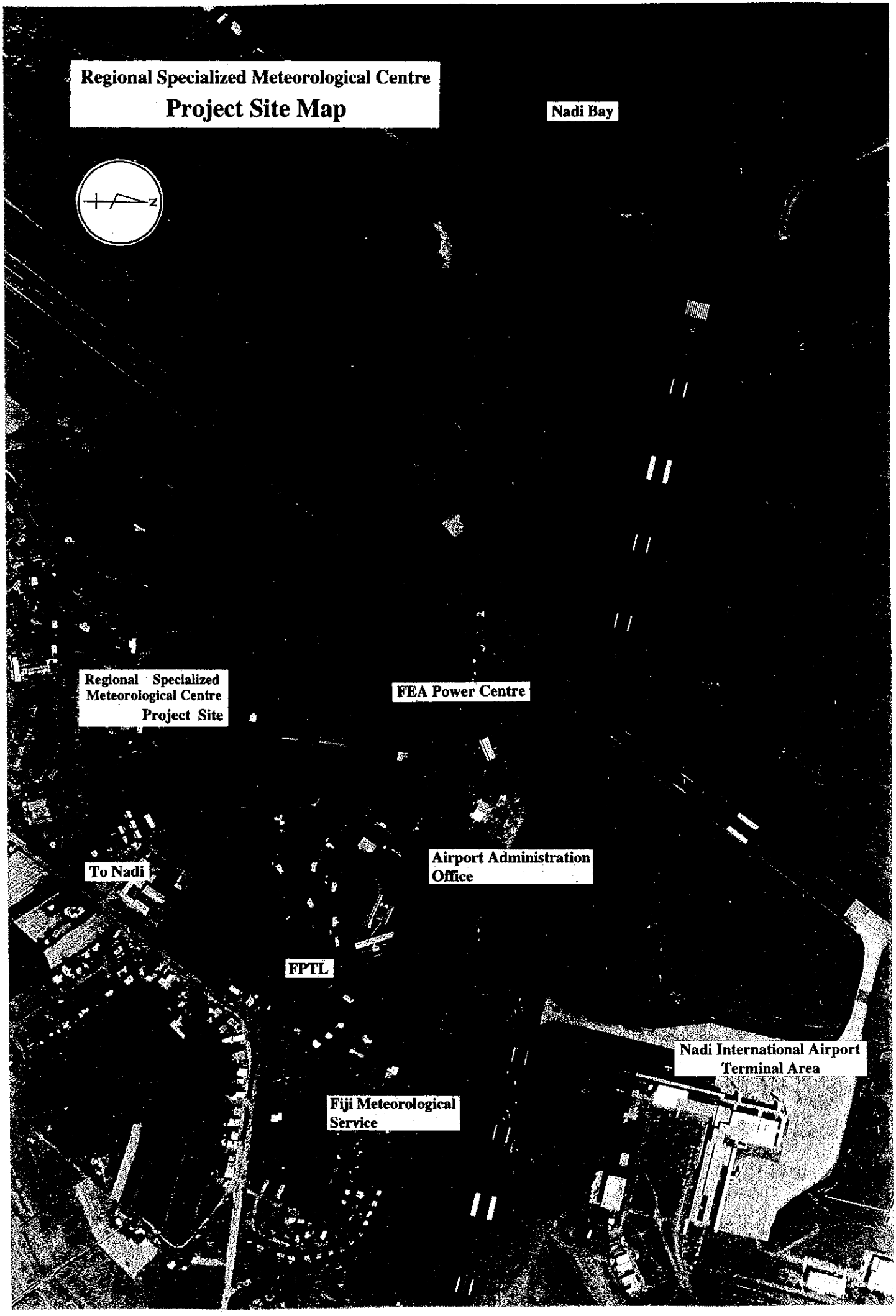
Regional Specialized Meteorological Centre

Location Map

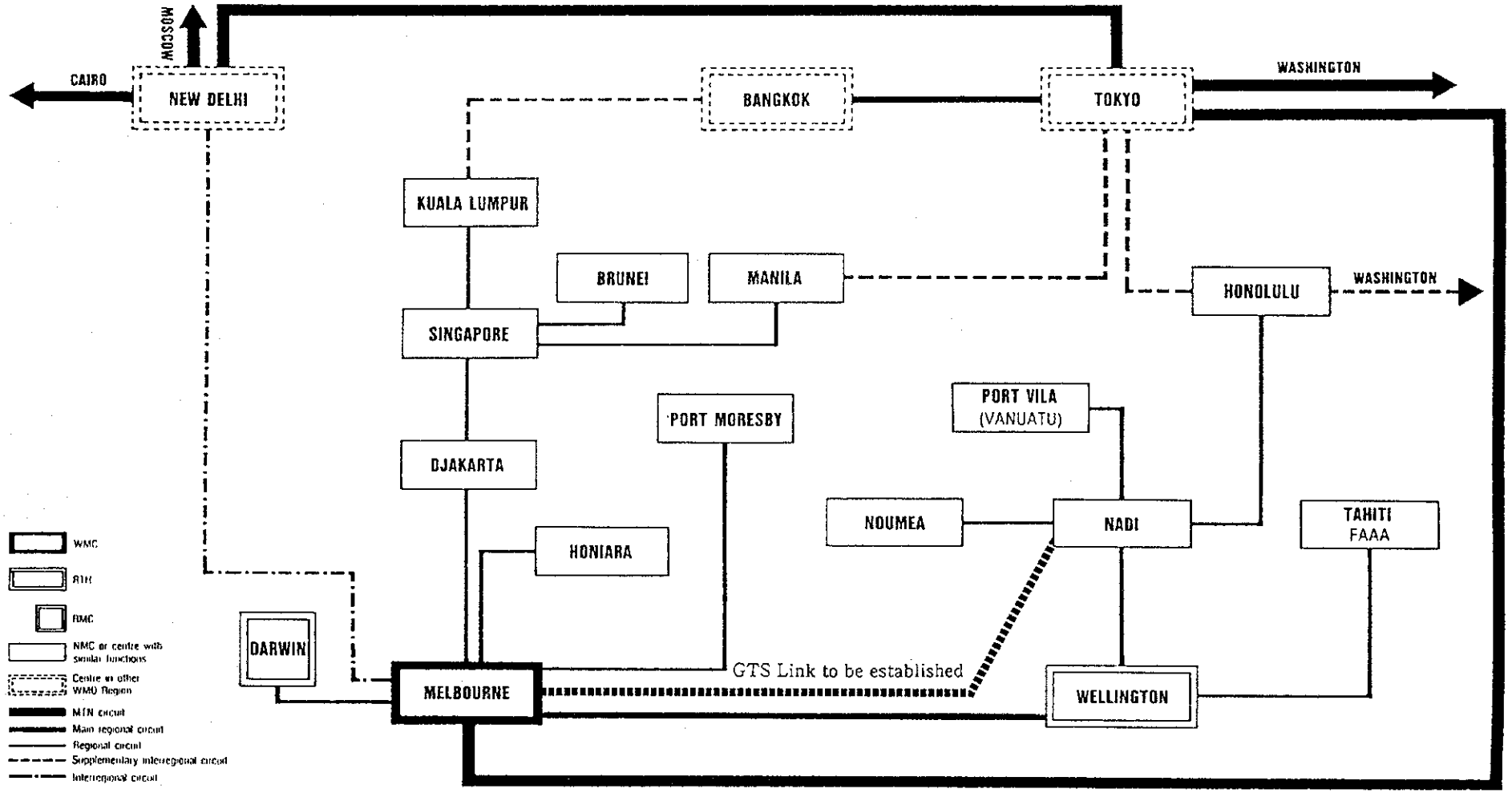


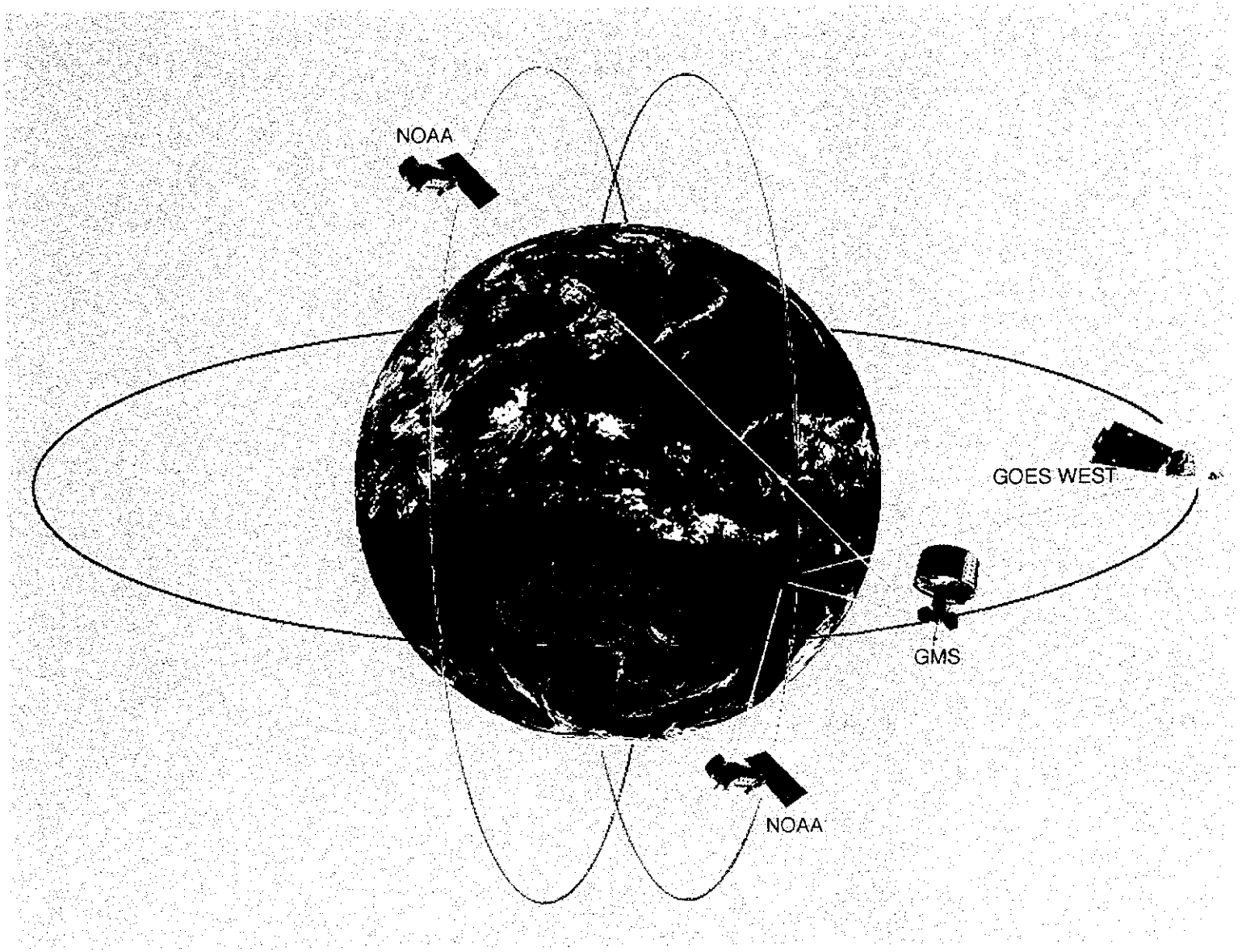
Fiji Islands




Regional Specialized Meteorological Centre
Project Site Map
Nadi Bay
Regional Specialized Meteorological Centre Project Site
FEA Power Centre
To Nadi
Airport Administration Office
FPTL
Nadi International Airport Terminal Area
Fiji Meteorological Service

Global Telecommunication Network for Region V, South-West Pacific





3 Meteorological Satellites to be received by Regional Specialized Meteorological Centre

Summary

South Pacific community, comprising of many island nations including Fiji, is affected seriously by the frequent visit of tropical cyclones which offer the highest potential for loss of lives and property. Regrettably, the extensive damage from tropical cyclones forms the determining cause for significant set-back of a national economy that depends primarily on agricultural activities. Fiji itself suffered the great financial losses in its history.
Looking back over only last several years, at least five tropical cyclones brought about major disasters to the island groups in the South Pacific:

- Tropical Cyclone MANU, Solomon Islands, May 1986. 106 People were killed or missing, and 90 thousand people were suffered;

- Tropical Cyclone UMA, Vanuatu, Feburuary 1987. 50 people were killed. Total damage amounted to US$ 1.5 million;

- Tropical Cyclone NINA, Solomon Islands, December 1992. Over 11,000 houses were destroyed or damaged and 4 people are dead/missing. Total economic loss was around S$20 million;

- Tropical Cyclone KINA, Fiji, January 1993. Twenty-eight people were killed or reported missing. Estimated loss incurred are US$42 million in agriculture, US$32 million in infrastructure, and US$26 million in social services, which totaled US$100 million;

- Tropical Cyclone PREMA, Vanuatu, April 1993. Approximately 7,000 people are left homeless. In Shepherd Islands, housing damage was estimated at 80% and crop loss at close to 100%. Total damage amounted to nearly US$60 million.

Under these circumstances, Fiji Meteorological Service (hereinafter referred to as "FMS"), as a government organization operating under the Ministry of Foreign Affairs, Tourism and Civil Aviation, is responsible for providing meteorological information for mitigation and prevention of natural disasters, and for development of socioeconomic activities. As regards meteorological services, most countries in the region are still in an early stage of development, and Fiji is hence expected to continuously play the leading role in providing more authentic warning for the reduction of tropical cyclone disasters in the South Pacific. FMS also provides meteorological information for shipping and aviation as scheduled, and daily weather forecasts to the general public of Fiji itself and 10 neighboring island countries.

Furthermore, FMS takes the high responsibility of tropical cyclone warning service as Tropical Cyclone Warning Centre (hereinafter referred to as "TCWC") of Regional Association V (hereinafter referred to as "RA V"), a regional body of World Meteorological Organization (hereinafter referred to as "WMO") for the Southwest Pacific. Nadi TCWC covers the vast area, from the equator to 25° South in latitude and 160° East to 120° West in longitude, and provides tropical cyclone information for as many as 12 states and territories in the region.

Tropical cyclone is a principal causes of meteorological disasters in the world. In order to improve warning response and facilitate regional cooperation against tropical cyclone disasters, WMO has designated some leading meteorological centres as Regional Specialized Meteorological Centres (hereinafter referred to as "RSMCs") with activities specialized in tropical cyclone analysis, tracking and forecasting within the framework of the World Weather Watch Programme (hereinafter referred to as "WWW") and Tropical Cyclone Programme (hereinafter referred to as "TCP") of WMO.

To meet the regional demand for further improvement of the preparedness against tropical cyclone disaster in the South Pacific, FMS is striving for the establishment of RSMC of WMO for the more responsible warning services for tropical cyclone disaster prevention. Upgrade of the observation and forecasting capabilities is therefore urgently required for FMS. Particularly, establishment of a computerized system for utilizing the satellite data and numerical weather prediction products is essential to function as RSMC.

In view of these circumstances, the Government of Fiji formulated a project for Upgrading of Meteorological Observation and Forecasting System in the Republic of Fiji (hereinafter referred to as "the Project") in March 1994, and made a request to the Government of Japan for the Grant Aid to realize the Project.

In response to this request, the Government of Japan decided to execute a basic design study and to dispatch the study team to Fiji between January 4 and January 28, 1995. During the basic design study, the study team ascertained and confirmed the background of the Project and contents of the request and also intensively carried out study of necessity of the Project and survey of the condition of the proposed site for construction of a building, infrastructures, transportation and other conditions related to the Project.

After the completion of the study in Fiji, the team examined the effects and contribution of the Project and the appropriateness for its implementation under Japan's Grant Aid Assistance. In consequence of the examination, the study team carried out a basic design of the Project and determined the optimum scale and particulars of the meteorological observation and forecasting system as RSMC to be established, the above results of the basic design study were compiled in a Draft Report. The Governement of Japan dispatched a second mission between March 22 and April 2, 1995, to explain the contents of the Draft Report and to discuss the report with the officials concerned with the Project in the Government of Fiji for its final confirmation.

Implementation agency of the Proiject is Fiji Meteorological Service under the supervision of Ministry of Foreign Affairs, Tourism and Civil Aviation of the Government of Fiji.

The Project consists of the construction work and installation & adjustment work of the equipment (including computer software). In accordance with the basic design study of the overall project term, the Project is to be divided into 2 phases.

The contents of the design made by the basic design team are as follows:

First Phase of the Project

The First Phase covers the construction of the facility and the installation & adjustment works of the following equipment.

a. Construction of Regional Specialized Meteorological Centre building
Location of the Site : Premises of Civil Aviation Authority of Fiji, Nadi airport
Total Floor Area: 1,443.55 m^2

b. Upper Air Observation Data Analyzer : Automatic receiving and analyzing system for upper air observation data utilizing the wind finding function of existing radar. The equipment will be installed at the radar site in Nadi International Airport.

c. Meteorological Instrument
Anemometer with wind vane
Barometer caligration chamber
Thermometer calibration water tank / Thermohygrostat
Wind sensor caribration equipment

d. Necessary spare parts for each equipment

Second Phase of the Project

The Second Phase covers the installation & adjustment work of the following equipment.

a. Computer System and Automatic Weather Chart Plotter
: Receiving meteorological data including numerical weather prediction data through GTS.

b. Satellite Data Receiving Equipment (Receiving NOAA and GMS images)
for NOAA : one (NOAA: Polar Orbiting Meteorological Satellite)
for GMS : one (GMS: Geostationary Meteorological Satellite)

c. Automatic Meteorological Observation System (Data collection from remote places)
Location of the site: Yasawa-i-rara, Viwa, Udu Pt, Vanuabalavu, Lakeba, Matuku and Ono-i-lau

d. Two pick-up vehicles for maintenance and emergency use

e. Necessary spare parts for each equipment

At the time of execution of the Project under Japan's Grant Aid Assistance, the estimated cost for the major undertaking of the Government of Fiji will be F$176,500.- for Phase I, F$40,000.- for Phase II and F$216,500.- in total.

After the implementation of the Project, it will be possible as the concrete benefits and effects of the Project;

- to meet the function and responsibility of RSMC as the centre of meteorological services in the South Pacific and to provide more authentic weather forecast and cyclone information & advisories to the nations of Fiji and neighboring island countries such as the whole population (1.54 million) of Fiji, Kiribati, Tuvalu, Vanuatu, Tonga, Western Samoa, Tokerau, Niue, New Caledonia, American Samoa, French Polynesia, Wallis Islands and Cook Islands.

- to watch the whole responsible area of RSMC by the establishment of GMS and NOAA satellite receiving systems for preparation of weather forecast.

- to forecast behavior and development of cyclones ahead of 48 hours with cyclone development model and sea surface temperature data to be caliculated by NOAA satellite receiving system.

- to disseminate the forecasts and warnings to the nations of Fiji and the neighboring island countries more promptly and accurately by minimization and rationalization of meteorological routine works using the computer system and automatic weather chart plotter.

- to exchange a large volume of meteorological information and data with other meteorological centers in the world through GTS link and to store and analize these useful meteorological information and data by the computer systems for improvement of accuracy of weather forecast and cyclone warning.

- to prepare meteorological data and information for forecasting as the same level as the developed countries through receiving them from GTS link and data analysis by the computer system.

- to contribute improvement of accuracy on numerical weather prediction of the developed countries due to prompt dissemination of accurate meteorological data from Fiji through GTS link.

- to execute training for meteorological staff of Fiji itself and the neighboring island countries at Regional Specialized Meteorological Centre in Nadi to be constructed under the Project for the development of manpower in the South Pacific region.

On the other hand, meteorological phenomena are behaviors of the global atmosphere, which exceed the sphere of every single country. Accordingly, international exchange of meteorological data is indispensable and essential for the worldwide meteorological services. Actually, such cooperation is realized by exchanging observation data and numerical weather prediction through GTS line all over the world with great success. The meteorological data

transmitted from all over the world enables the numerical weather prediction in Japan. In turn, the numerical weather prediction products provided by Japan together with the satellite image from Japanese geostationary meteorological satellite "GMS" contributeto the mitigation of meteorological disasters in the Asian Pacific countries. This is surely an ideal posture of international cooperation.

The Project is expected to produce the considerable benefits as mentioned above. The Project will substantially contribute to the development of the socio-economic activities of the people of the Republic of Fiji and the South Pacific countries. Therefore, the realization of the Project is considered to be truly significant. Furthermore, for the operation and administration of the system to be introduced under the Project, there is no substantial problem in respect to personnel or funds of the organizations of the Republic of Fiji.

In addition, by expediting and improving the following circumstances, the effects of the Project will efficiently and appropriately be increased and contributed further to the neighboring countries.

- In order to exhibit the effects and profit of the Project efficiently, it will be required to establish a computer section in FMS, to ensure engineers and to upgrade their technical skills on operation & maintenance for the computer hardware & soft ware to be introduced under the Project.

- In the consideration of the localization of FMS personnel within next 3 years, it is desirable to continually cultivate the forecasters and engineers in FMS for mitigation of the technical level down.

- It will be useful to establish a section or a post to be specially assigned for observation, analysis and forecast of tropical cyclones for contributing the prevention of tropical cyclone disasters in the South Pacific.

- At the present, the neighboring island countries of Fiji are only receiving meteorological information from FMS through AFTN link. In a case of GTS link to be established among the neighboring island countries, they will be able to receive large volume and high quality of meteorological information from FMS, therefore, it will contribute to upgrade the accuracy of weather forecasting in the South Pacific.

- After completion of the Project, the training facilities will be improved. training for meteorological personnel in the South Pacific will be able to execute at the training room of Regional Specialized Meteorological Centre for contribution of expanding the effects of the Project to the whole region.

- For further increasing the effects of the Project, it will be useful to apply the results of the technical cooperation being executed by Australia and New Zealand for the operation of the system to be introduced under the Project.

CONTENTS

Appendices

Chapter 1. Background of the Project

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1-1 Background of the Project

The South Pacific is one of the regions most vulnerable to the impacts of tropical cyclones. With numbers of isolated island groups comprising largely of low and small coral islands, the nations of this region are inevitably exposed to the serious threat of these storms and thus offer the highest potential for loss of life and property. Regrettably, the extensive damage from tropical cyclone even forms the determining cause of significant set-back of a national economy that depends primarily on agricultural activities. Fiji itself also has suffered a great loss due to tropical cyclones in the past.

Looking back over only last several years, at least five tropical cyclones brought about major disasters to the island groups in the South Pacific, which led to international relief assistance by UN Agencies and volunteer countries including Japan:

- Tropical Cyclone MANU, Solomon Islands, May 1986. 106 People were killed or missing, and 90 thousand people were suffered;

- Tropical Cyclone UMA, Vanuatu, Feburuary 1987. 50 people were killed. Total damage amounted to US$ 1.5 million;

- Tropical Cyclone NINA, Solomon Islands, December 1992. Over 11,000 houses were destroyed or damaged and 4 people are dead/missing. Total economic loss was around S$20 million;

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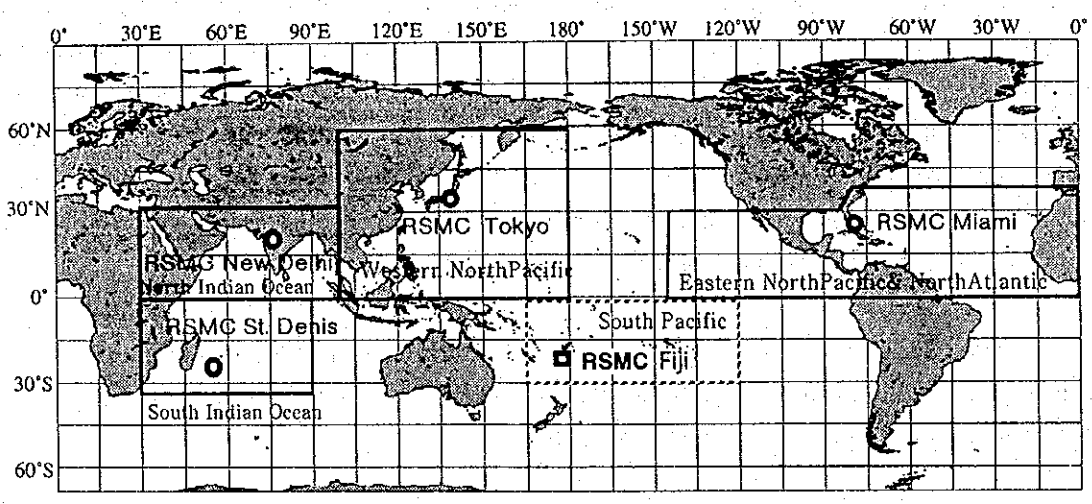
- Tropical Cyclone PREMA, Vanuatu, April 1993. Approximately 7,000 people are left homeless. In Shepherd Islands, housing damage was estimated at 80% and crop loss at close to 100%. Total damage amounted to nearly US$60 million.

Located in the midst of the tropical cyclone basin as described above, FMS (Fiji Meteorological Service) takes the high responsibility of tropical cyclone warning service as TCWC (Tropical Cyclone Warning Centre) of RA V (Regional Association V), a regional body of WMO (World Meteorological Organization) for the Southwest Pacific. Nadi TCWC covers the vast area, from the equator to 25° South in latitude and 160° East to 120° West in longitude, where as many as 14 states and territories are located. These island countries due in large part to Fiji in meteorological services including provision of tropical cyclone warning because their services are still in a developing stage on facilities and tecknology. Fiji is hence requested to continuously play the leading role in this field and make possible endeavours towards reduction

of the damage from tropical cyclones by ensuring more authentic warnings. In the light of such a vital role of Nadi TCWC, RA V has proposed that Nadi be upgraded to RSMC (Regional Specialized Meteorological Centre) of WMO for the Southwest Pacific region.



Location of RSMCs and Responsible Territories

In order to facilitate regional cooperation against tropical cyclone disasters, WMO has designated some leading meteorological centres as RSMCs with activity specialization of tropical cyclone analysis, tracking and forecasting within the framework of WWW (World Weather Watch Programme).

As the RSMC Tokyo in the western North Pacific, Japan Meteorological Agency has the responsibilities of providing the information on the occurrence, intensity, and track of typhoons as required in the region to the members of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and the Typhoon Commission of WMO including the Philippines, Vietnam, China, and Hong Kong.

Four centres have so far started functioning as RSMC in each tropical cyclone disaster prone area; RSMC Tokyo for the western North Pacific, RSMC Miami for the North Atlantic and eastern North Pacific, RSMC New Delhi for the North Indian Ocean, and RSMC St Denis (Reunion) for the South-West Indian Ocean. These RSMCs maintain close liaison with each other and thereby maximize consistency and improve their capabilities in tropical cyclone operation.

Under these conditions, FMS is now striving for establishment of RSMC for the Southwest Pacific region. To meet the functions required as a RSMC, it is urgent for FMS to improve the observation and forecasting capabilities through establishment of the computer system for obtaining and utilizing data such as the numerical weather prediction products, meteorological satellite data and domestic observation data.

In the meantime, FMS requested the Government of Japan to dispatch a meteorological expert for technical advice in connection with the establishment of RSMC. As a response for the request, the Government of Japan dispatched a short-term expert as arranged by JICA (Japan International Cooperation Agency) for a period of three months from April, 1993. With the actual conditions of FMS in mind, the expert gave FMS a concrete recommendation to FMS on the necessary improvement to meet the function as a RSMC.

Based upon the above circumstances, the Government of Fiji has prepared a project for upgrading of meteorological observation and forecasting system and requested the Government of Japan to execute Japan's Grant Aid Assistance for actualization of the project.

1-2 Outline of the Request and Main Components

1-2-1 Outline of the Request

(1) Purpose of the Request

The request has its purpose aimed at improving the weather observation and forecasting system of FMS for enhancement of meteorological services in Fiji itself and the neighboring countries which receive the weather information from FMS.

(2) Contents of the Request

The contents of the request made by the Government of Fiji are as follows.

(a) Facility

Address of the Site : Civil Aviation Authority of Fiji premises, Nadi airport

Forecast Centre Building (total floor area: 1,500 m^2)

Instrument Room	(60m^2)	Work-shop	(90m^2)
Training Room	(90m^2)	Office Area	(60m^2)
Conference Room	(50m^2)	Library	(50m^2)
Machine Room	(50m^2)	Electricity Room	(70m^2)
Forecast Room	(140m^2)	Data Storage Room	(90m^2)
Observation Room	(125m^2)	Tropical Cyclone Warning Room	(40m^2)
Communication Room	(125m^2)	Studio	(20m^2)
Barometer Room	(25m^2)	Dark Room	(25m^2)
Other Common Areas	(290 m^2)		
Engine Generator Shed	(100m^2)		

(b) Equipment

(i) Computer System

: Receiving numerical weather prediction data,
Automatic weather chart plotter

(ii) Satellite Data Receiving Equipment

: Receiving NOAA and GMS images
for NOAA : one (NOAA : Polar Orbiting Meteorological Satellite)
for GMS : one (GMS: Geostationary Meteorological Satellite)

(iii) Automatic Meteorological Observation Equipment

: Data collection from remote places

(iv) Meteorological Instrument

: Replacement of obsolete meteorological instruments

1-3 Project and/or Program of Other Donors

In order to avoid any duplication of assistance in the meteorological field for Fiji, a study was made of major donor-nations & organizations in Fiji and their achievements and programs, and an exchange of opinions was made. The nations and organizations which were made the subjects of study were AIDAB/AusAID (Australia. The name was changed from AIDAB to AusAID in this March), New Zealand, USAID (U.S.A.), Delegation of the European Commission for the Pacific (EU) and UNDP/UNDHA (UN). We explained to each organization on the contents of the project, schedule, etc. and confirmed that there is no duplication with any of their projects. We also recognized the importance of keeping in touch with each other for exchange of information in the future.

The assistance programs of each country or organization is as follows:

(1) Australia, AIDAB/AusAID

As aleading country in WMO's region V as Fiji, Australia has a record of tremendous contributions in various types of assistance and cooperation in the meteorological field not only to Fiji, but also to other countries of the South Pacific.

A recent assistance by Australia is a grant extended to the Fiji Meteorological Service of 2 sets of weather radars, each installed at Nadi and Suva. The schedule in 1995 calls for a grant of the digital facsimile receiver (DIFACS) in response to the opening of the GTS circuit between Nadi and Melbourne, as well as a grant of the packet switches to share the GTS

circuit for transmitting radar data. These items will be utilized along with the new system to be installed under the Project and they will compensate for each other.

Furthermore, there is an Australian expatriate forecaster working and executing a technical transfer in FMS. The personnel expenses are borne in part by Australia. Further, the training of Fijian staff from FMS is currently held in Australia and this is scheduled to be held on a continuous basis.

Another projects by AIDAB is to develop a sea level observation network in the South Pacific (South Pacific Sea Level and Climate Monitoring Project). One of the observation stations is located in Lautoka, Fiji. The observation data are collected via satellite by the National Tidal Facility (NTF) in Adelaide, Australia and sent to FMS on a monthly basis. However, there is a possibility that FMS will be able to obtain those data in real-time through the GTS circuit after the completion of the Project.

(2) New Zealand

New Zealand ranks the same as Australia in that she is one of the major assistance countries to the South Pacific. Fiji is also a recipient nation over a long period of time because FMS had been operated as a branch of the New Zealand Meteorological Service until 1975. In 1992, the New Zealand Meteorological Service was shifted to a private sector established and financed by New Zealand government and became the Meteorological Service of New Zealand Ltd. Under a contract with the New Zealand government, however, they have still been extending international cooperation mainly in the technical cooperation field to date.

The training of the staff members of FMS has so far been conducted in New Zealand and it is expected to be continued. In 1995, a trainee is scheduled for training in Australia to be a forecaster financially assisted by New Zealand. Moreover, the FMS has invited some New Zealanders as expatriates. Under the same program, there are currently 3 expartriates working. This is based on a Project "Management Services Consultancy - Fiji Meteorological Service, 1993-1998", therefore the expartriates working at FMS are supposed to be replaced eventually by the local staff.

The verification of meteorological instruments has been made mainly with a technical cooperation of New Zealand. Standard instruments were verified by New Zealand to be used for domestic verification in Fiji.

(3) USA, USAID, NOAA, NASA

In 1986, the United States donated a geostationary meteorological satellite data receiver & analyzer (currently used for reception of Japanese satellite "GMS" data) through NASA/USAID ("South Pacific Severe Storm Detection and Warning System (SPSSD/WS) project").
At the end of last year, the analyzer software for the equipment has been updated to a new version. Incidentally, FMS intends to transfer the equipment for reception of data from the American geostationary meteorological satellite "GOES-WEST" upon completion of the project in question. For this purpose, the software has to be modified and a request will be made to the United States.

In addition, NOAA (National Oceanic and Atmospheric Administration of USA) has established an automatic observation station in Suva to observe tide levels. As in case of the Australian system, the data are automatically collected by NOAA and fed back in the form of a monthly report to the local service.

(4) EU (Delegation of the European Commission for the Pacific)

At present, EU has an assistance project in the field of meteorology directed to the countries in the South Pacific region in the vicinity of Fiji (Cyclone Warning System Upgrade in the Region). The project consists mainly of training and equipment supply programs. Upon completion of the Project and this program, reciprocally beneficial effects can be expected.

This project by EU is expected to be approved in April, this year and the term of execution is about 3 years. As far as the schedule is concerned, the Japanese project will precede the EU project. In this connection, the EU side has made it clear that they are ready to depart from the current specifications if required. Further, EU agreed to exchange information each other on both projects to enhance weather services in the South Pacific by effective assistance.

(5) UN, UNDP, UNDHA

For four years from 1987, there had been in this district a regional project with budget of approximately US$1 million, called the "Support to the Tropical Cyclone Programme in the South Pacific". After completion of the project, UN DHA materialized a new project named as "the South Pacific Disaster Reduction Programme (SPDRP)" (4 years from 1994 at US$1.2 million). The effect of this Project will probably be beneficial to SPDRP but nowhere will it show a duplication.

Outline of Project and/or Program executed by Other Donors

Donor	Technical Cooperation / Equipment Supply	Term	Content
AusAID	Equipment Supply	1993~1994	Weather Surveillance Radar at Nadi &Nausori
	Equipment Supply	1995	Digital Facsimile System (DIFACS)
	Technical Cooperation	Annually	Training for forecasting course in Australia
	Technical Cooperation	Regularly	Supplementation of Senior Forecaster (burden sharing)
	Technical Cooperation	Regularly	South Pacific Sea Level and Climate Monitoring Project
	Equipment Supply Technical Cooperation	1994~1996	Pacific Meteorological Services Project
New Zealand	Technical Cooperation	1994~1998	Training for forecastong course in Australia &NZ
	Technical Cooperation	Regularly	Supplementation of Senior Forecaster
	Technical Cooperation	~1992	Calibration of meteorological equipment
USA	Equipment Supply	1986	Satellite Data Receiving Equipment
	Technical Cooperation	1994	Satellite Image Processing Software Version-up
EU	Technical Cooperation / Equipment Supply	1995~1998	Cyclone Warning System Upgrade in the Region
UN	Technical Cooperation / Equipment Supply	1987~1990	Support to the Tropical Cyclone Programme in the South Pacific

Chapter 2. Outline of the Project

Chapter 2 Outline of the Project

2-1 Objectives of the Project

FMS is mainly responsible for providing meteorological information necessary for mitigation and prevention of meteorological disasters and development of socio-economic activities. FMS is also providing meteorological information for shipping and aviation as scheduled, and daily weather forecasts to the general public of Fiji and 9 other neighboring island countries. Concerning tropical cyclone in the South Pacific, FMS disseminates warnings and advisories to as many as 12 states and territories as Tropical Cyclone Warning Centre (TCWC) designated by the Region V of WMO.

On the other hand, WMO has recommended FMS to strive for establishment of RSMC of WMO for tropical cyclone warning services in the Southwest Pacific Region which will come fifth in the world, in order to meet the increasing national and regional demand for the reduction of such disasters. This situation urgently requires that FMS should upgrade its observation and forecasting capabilities to meet the necessary functions and responsibilities of the RSMC.

Due to the above circumstances, the objectives of the Project are;
(i) to improve meteorological observation and forecasting systems in order to meet the function as RSMC for the reduction of natural disasters such as tropical cyclones in the South Pacific region,
(ii) to construct a new building as "Regional Specialized Meteorological Centre" in Nadi in order for betterment of the existing condition of FMS,
(iii) to install the necessary systems (Computer system for data communication, processing & analysis, Satellite image receiving system, Automatic meteorological observation system, Upper air observation system, Wind vane & anemometer and Calibration equipment for meteorological instrument) for improvement of meteorological services to prepare more accurate and enriching and
(iv) to disseminate more speedily meteorological information and warnings of tropical cyclone through GTS link and AFTN link to the nations of Fiji and the neighboring countries.

Therefore, the objectives of this Project should not be merely upgrading of the systems and facilities of a meteorological organization, but should be the aim for FMS to be improved responsible for providing meteorological services to Fiji and the neighboring countries as the central meteorological organization in the South Pacific, taking well into consideration that it will comprehensively perform its duty as the Regional Specialized Meteorological Centre in the Southwest Pacific.

2-2 Study and Examination of the Request

In connection with the execution of the Project, the capability of Fiji for the practicability of the Project has been ensured and confirmed, and also the effect of the Project has been confirmed in accord with the system of Japan's Grant Aid Assistance.
In consequence of the study and examination, it is judged as pertinent and appropriate project in order to execute under Japan's Grant Aid Assistance.

1. Items requested by the Government of Fiji

Through the discussions between the government of Fiji and the basic design study team, the following items were requested by the Fiji side.

1) Construction of Regional Specialized Meteorological Centre

Location of the proposed site :

Civil Aviation Authority of Fiji premises, Nadi International Airport

2) Meteorological Observation & Forecasting System

a. Computer System with Automatic Weather Chart Plotter
b. Satellite Data Receiving System for GMS and NOAA
c. Automatic Observation Equipment number of the systems was described in order of the priority of necessity.
d. Meteorological Instrument
e. Upper Air Observation Data Analyzer
f. HF Facsimile Transmitter
g. Two pick-up vehicles for maintenance and emergency use and necessary spare parts of the above systems.

However, the final components of the Project is decided as in "Chapter 3, Basic Design" in this report.

2. Result of Examination of the Request

The request from the Fiji side has scrutinizingly been examined and confirmed the necessity of each content of the request by the study team in Japan.

The results of the examination of the request are described as follows.

1) Computer System

The computer system will be introduced for high speed data communication with Melbourne, Australia through GTS link and acquisition of useful meteorological information such as numerical weather prediction products and domestic/worldwide observation data. The system is indispensable also for preparation of forecast support information by weather chart plotting and analyzed image display.

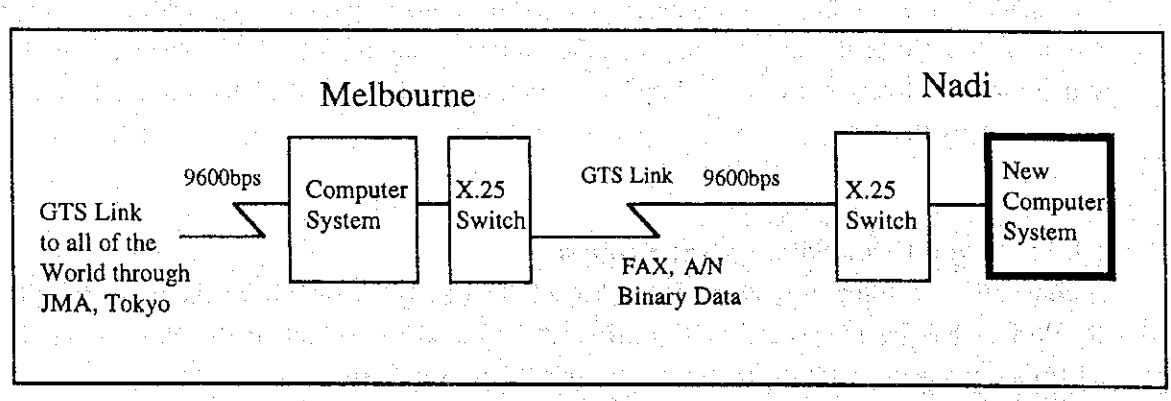


Fig. 2-1 GTS Link between Melbourne and Nadi

2) Satellite Image Receiving Equipment

In order to act as the Tropical Cyclone Warning Center in the Region V of WMO today and at the same time to cover the responsible area of the RSMC of WMO in the future, not only the data from the "GMS" currently used, but those from GOES-WEST, a stationary weather satellite of the U.S.A. located further to the east as well as NOAA, a polar orbiting satellite, will be required. For this purpose, a new data receiving systems for GMS and NOAA, will be introduced and the existing equipment will be used for GOES-WEST.

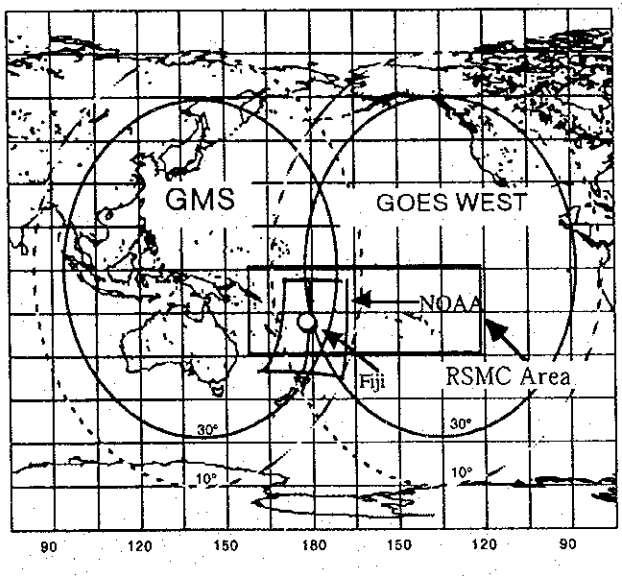


Fig.2-2 Observation Area of 3 satellites

3) Automatic Meteorological Observation Equipment (DCP)

Based on the results of the investigation and study, seven installation sites were selected out of a total of 11 sites requested by Fiji, excluded are Ceva-i-ra (4), Levuka (9), Vunisea (10), Nabuduwalu (11) (Figures in brackets show the priority made by Fiji). Although, Vanuabalavu and Lakeba are islands with comparatively convenient transport with regular air services, they have been selected because of the geographical importance as regards tropical cyclone movements.

By the reasons of the followings, 7 locations were selected for the automatic meteorological observation equipment to be installed under the Project.

1. ONO-I-LAU 5. MATUKU

In order to observe and monitor cyclones between Fiji and Tonga, these two islands are indispensable.

2. YASAWA-I-RARA 3. UDU PT 4. VIWA

These points are important to monitor cyclones coming toward Fiji from north, northwest and northeast or north, since they are located in the northe edge of Fiji islands.

6. VANUABALAVU 7. LAKEBA

By the same reason as above thses islands are important to monitor cyclones coming toward Fiji from east.

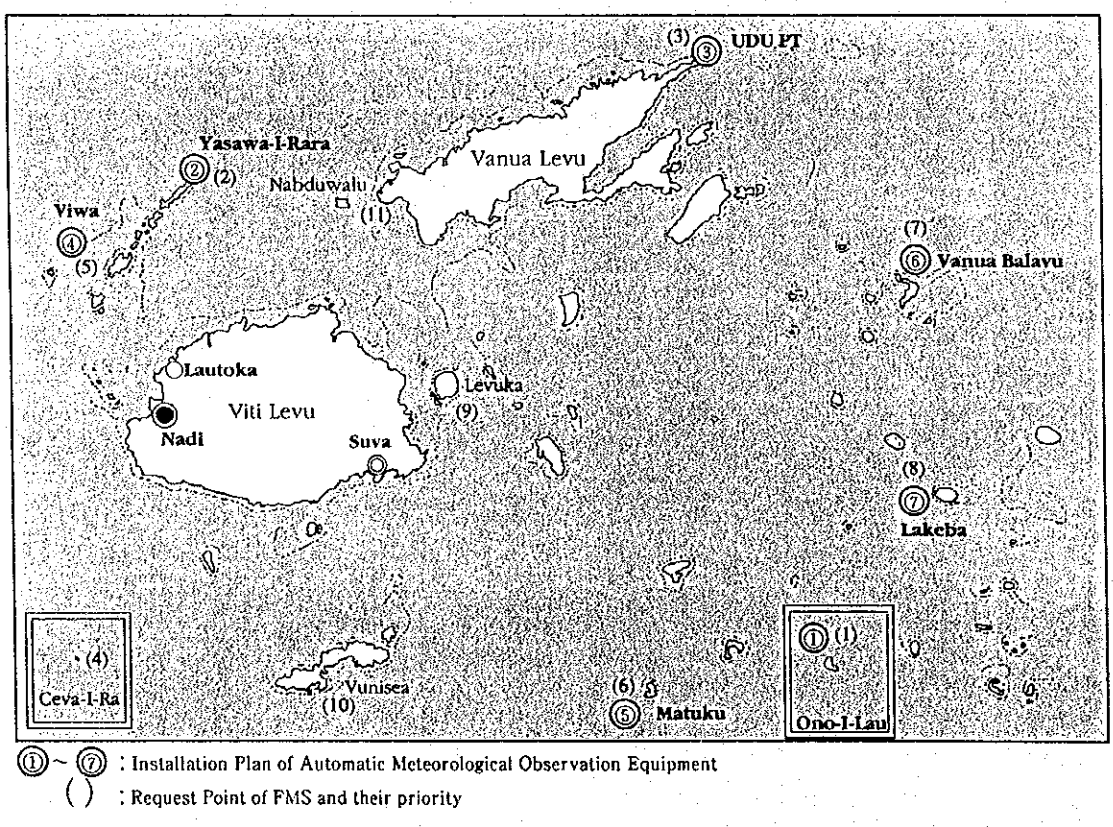


Fig. 2-3 Location Map of Automatic Meteorological Observation System

4) Upper Air Observation Data Analyzer

Radiosonde data analyzer for upper air observation

In order to minimize the time and the personnel on observation work for data receiving and analysis of upper air observation, the automatic observation data analyzer system will be installed at the radar site in Nadi International Airport. At the present, it needs four persons at each time of observation.

5) Meteorological Observation instrument

The anemoscope and anemometer set is to be installed on the roof and remote observation for wind speed and direction will be carried out at the forecasting room in Regional Specialized Meteorological Centre to be constructed under the Project.

The calibration equipment of the meteorological observation instruments is to be provided, and used for the calibration service of the observation equipment in Fiji and the neighboring countries.

- Calibration cistern for barometer 1 set
- Calibration cistern for thermometer of constant temperature and constant humidity/warm water cistern 1 set each
- Calibration equipment for anemoscope and anemometer 1 set

6) HF Meteorological Facsimile Transmitting System

During the basic design study in Fiji, it was newly requested to the study team as a method of dissemination for meteorological information to the neighboring island counties. After scrutinization and examination on HF meteorological facsimile transmitting system, it was not listed the content of the Project and also it was not included in the original application form as the request from the Government of Fiji.

In case of consideration of the necessary transmitting ability and output power covering the sea area between the equator and lat. 25° S, long. 160° E and long. 120° W in the Southwest Pacific as the responsible area of TCWC or limited transmitting area up to Cook Island, this system will be a very big scale system and HF meteorological facsimile transmitting system is not advanced technology nowadays, in fact. In the not too distant further, a meteorological dissemination method will be changed to a satellite transmitting system. Therefore, it is necessary to examine and consider other dissemination methods as RSMC to the neighboring countries in the South Pacific. FMS is responsible for providing information as the tropical cyclones warning centre against tropical cyclones in the Region V of WMO.

After completion of the Project, FMS is going to be able to disseminate very reliable and accurate meteorological forecasting information as alphanumeric data to neighboring countries by AFTN line. It is one of the great effects and contribution of the Project.

In the near future, the neighboring counties of Fiji in the South Pacific region should establish their own GTS link for improvement of meteorological services and prevention of natural disasters (tropical cyclones). At the time of GTS link established, the effects and contribution of the Project will be greatly expanded due to advanced meteorological data exchange between neighboring countries and RSMC in Fiji.

In addition, FMS should continuously try to realize improvement of a dissemination method for meteorological information to the neighboring countries in the future for prevention of tropical cyclone disasters as RSMC, after completion of the Project.

2-3 Project Description

2-3-1 Execution Agency and Operational Structure

1. Ministry of Foreign Affairs, Tourism and Civil Aviation

The Ministry of Foreign Affairs, Tourism and Civil Aviation the supervising ministry of FMS which is the executing agency of the Project. The organization chart of the Ministry of Foreign Affairs, Tourism and Civil Aviation is shown in the following Table (Fig. 2-4).

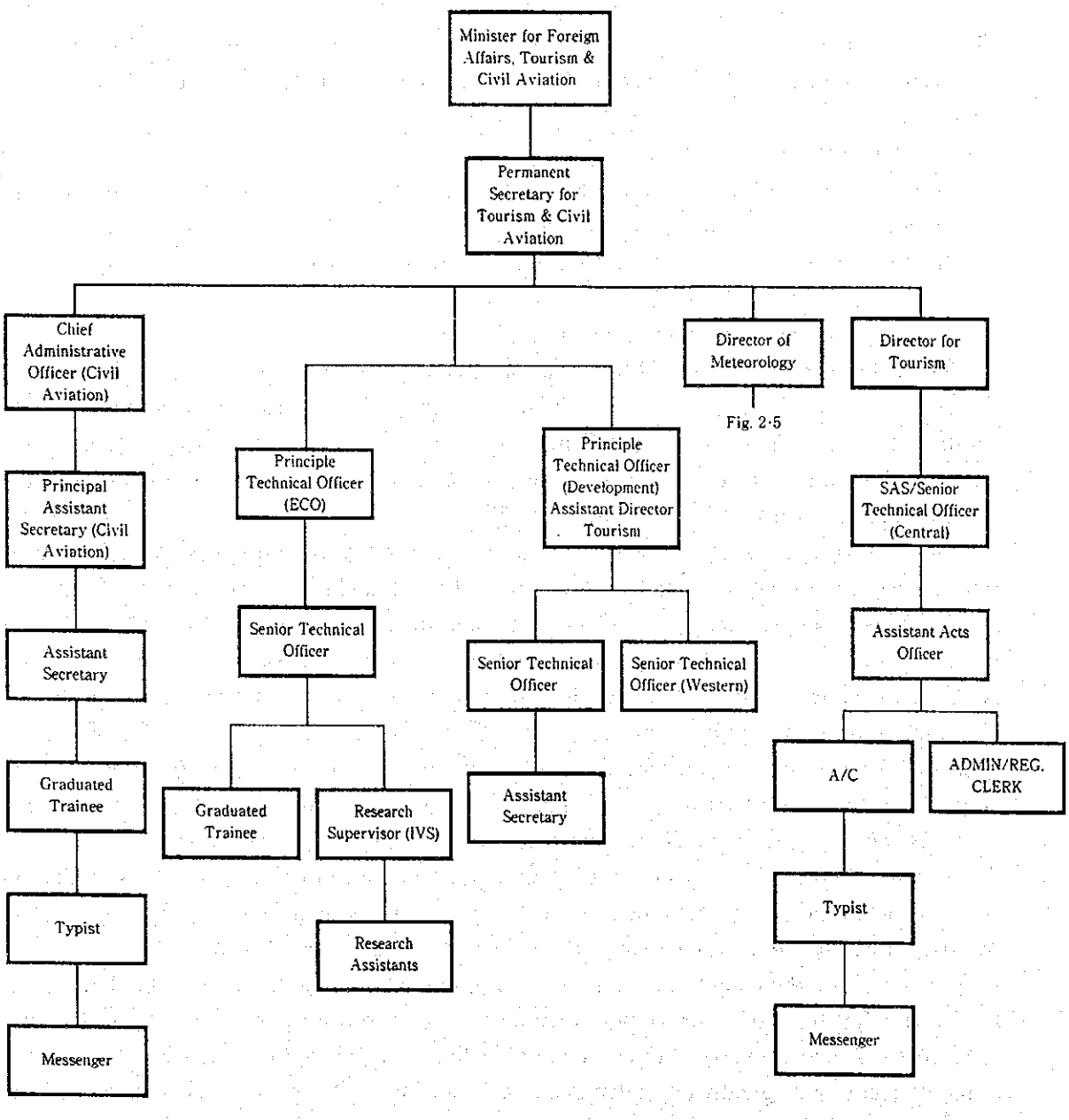


Fig. 2-4 Organization Chart of Ministry of Foreign Affairs, Tourism & Civil Aviation

2. Organization of the Fiji Meteorological Service (FMS)

With its head office located at Nadi Airport, FMS consists of 12 domestic weather observation stations and 4 airport observation stations. Of these, 3 airport observation stations are commissioned to CAAF (Civil Aviation Authority of Fiji). Furthermore, main services including the dissemination of information to the general public are provided centrally by the head office in Nadi.

The head office consists of general affairs, forecasting, observation, climatology & research, and reporting sections. Due to a problem with the accommodation capacity of the Nandi International Airport Terminal Building, people are working split into two groups; one of them is working at the National Weather Forecast Centre (NWFC) located in the terminal building, while the other group is in another building as the head office of FMS on the same premises as the airport.

The present meteorological services such as forecasting, observation and communication are provided at NWFC, while general clerical services including climatology & research, reporting and administrative services are provided at the head office building. The present organization chart of FMS (Fig. 2-5) is as attached herewith.

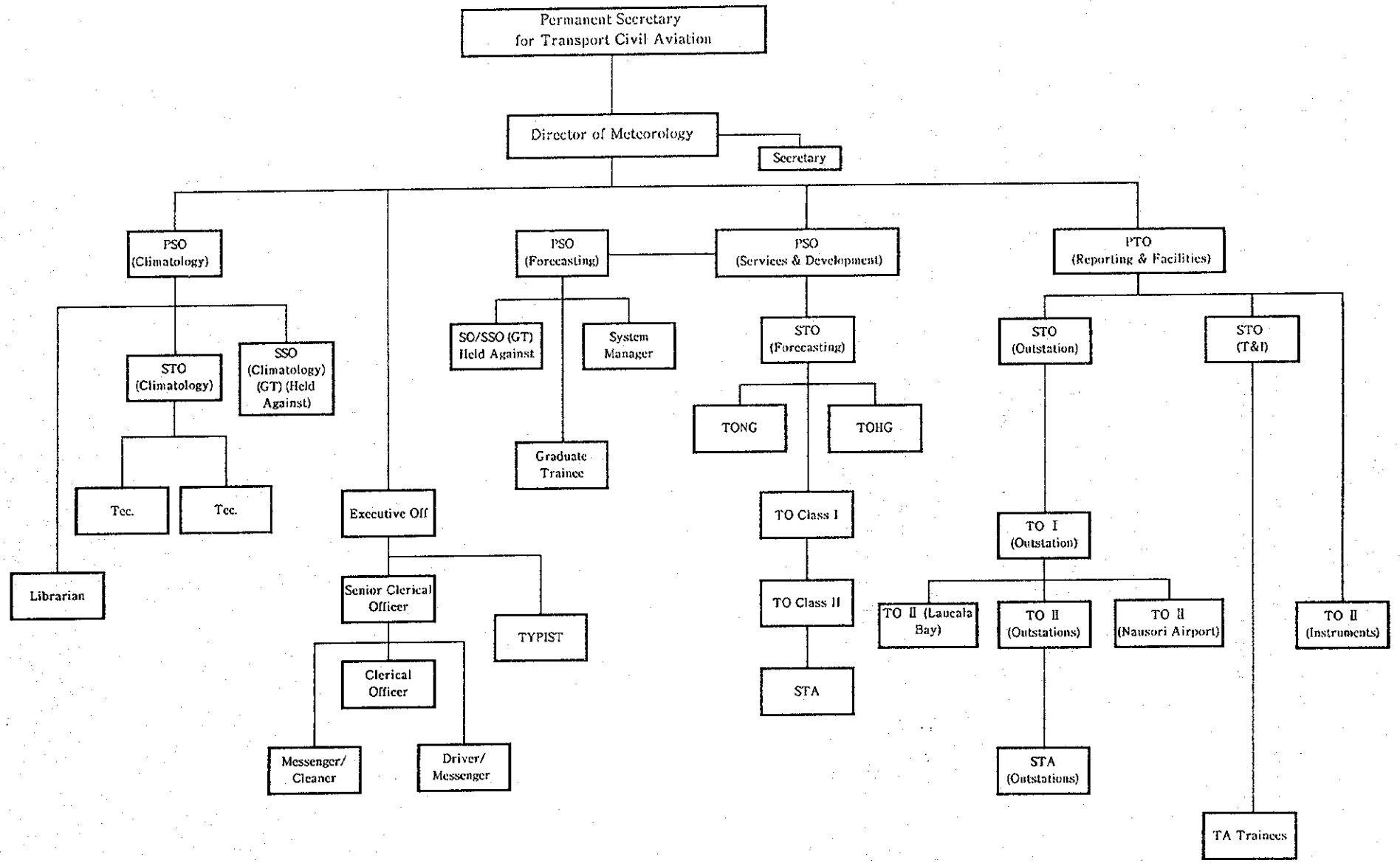


Fig. 2-5 Organization Chart of Fiji Meteorological Service

- Personnel

There are 88 people working altogether at the FMS (as of March, 1995).
They are classified as follows.

Director	:	1
Professional staff	:	14
Technical staff	:	67
Administration staff	:	6
	Total	88

Broken down by service area, they are classified as follows.

Nandi	:	59
Suva	:	3
Nausori	:	6
Other stations	:	20

In addition, the present status of the staff of FMS related to the forecasting and computer system is as follows.

* Forecasting staff

Currently, the number of regular staff for forecasting is 12. As of the end of March, 1995, however, there are only 9 of them covering routine daily services. Broken down by nationality, they are 5 Fijians, 3 New Zealanders, and 1 Australian in addition to 2 Fijian who are now under training in New Zealand.

* Computer system staff

- Software -

Since September, 1994, a system manager from the Information Technology and Computing Services Department (hereinafter referred to as "ITC") of the Government of Fiji (the organization chart is Fig. 2-6 and the computer network configuration of the Government of Fiji managed by ITC is Fig. 2-7) has been assign to FMS as in charge of the maintenance and management of software.

- Hardware -

The maintenance and management of the existing computer hardware at FMS is currently executed by engineers of the Civil Aviation Authority of Fiji (CAAF). The maintenance and management conditions of the existing computer systems (USA, Digital Equipment Corporation, Micro VAX II) belonging to CAAF are satisfactory and their maintenance and management capabilities are sufficient and appropriate.

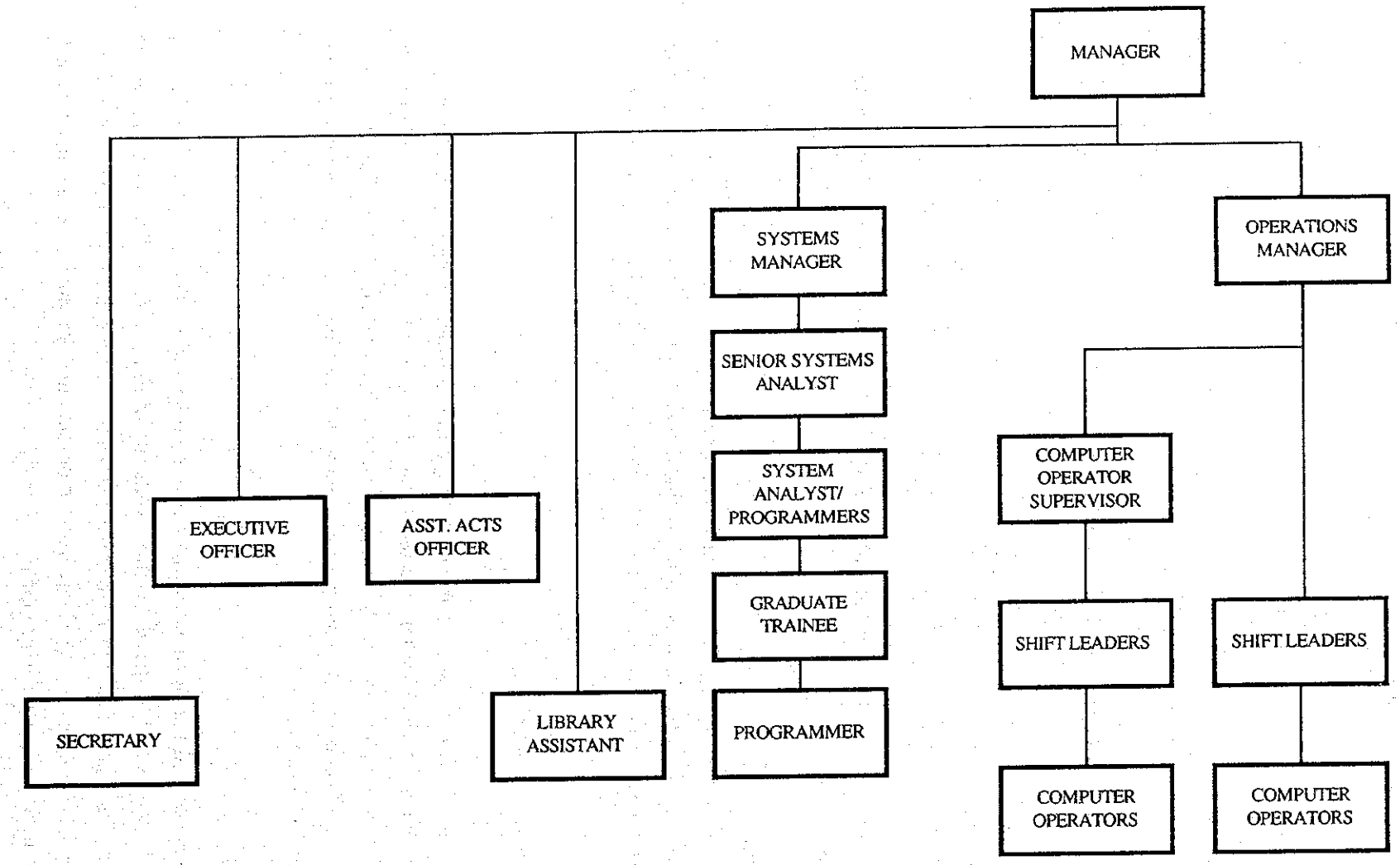


Fig. 2-6 Organization Chart of I.T.C. Services

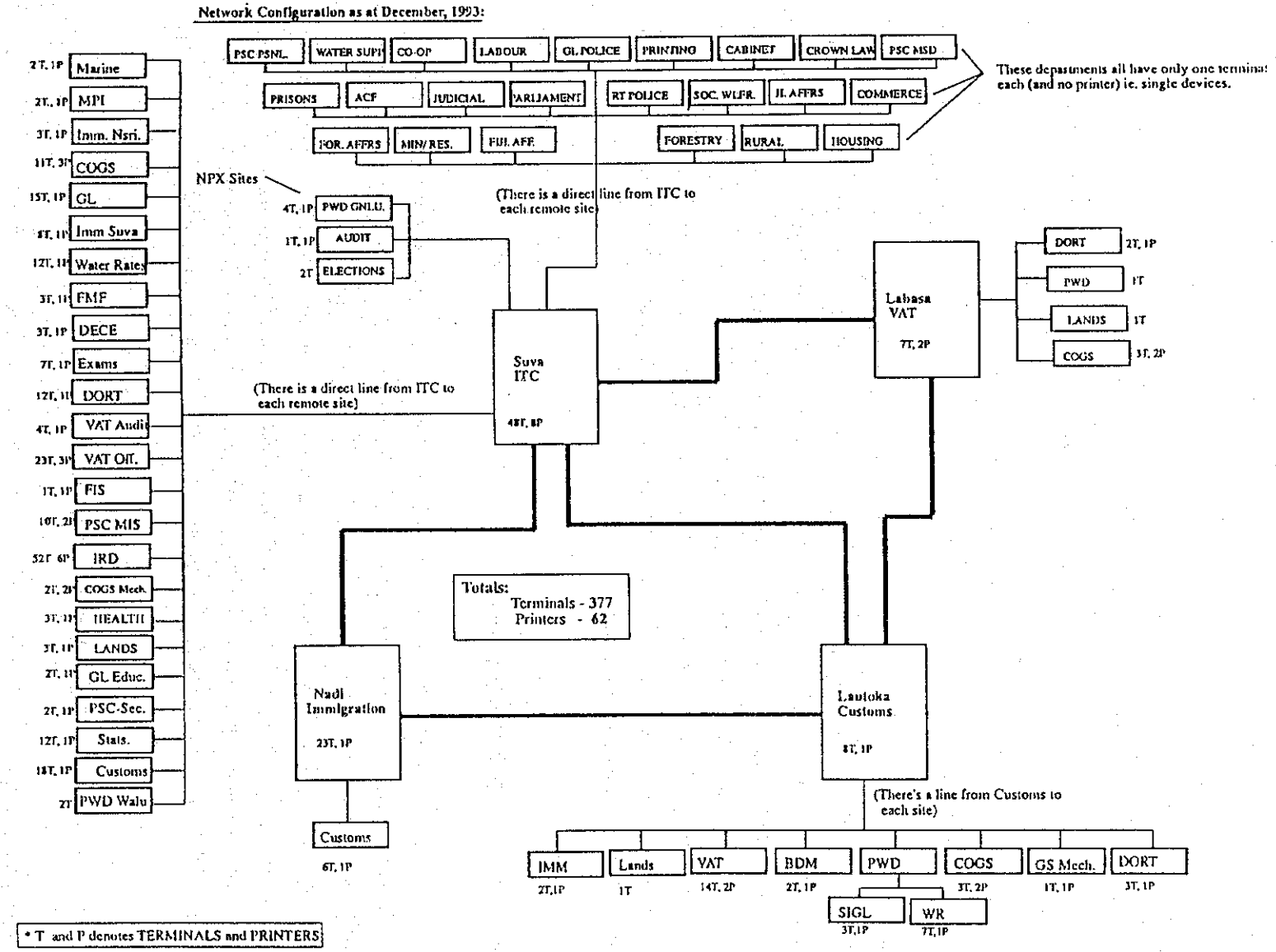


Fig. 2-7 Computer Network Configuration of the Government of Fiji (December, 1993)

3. Budget

The budgets for FMS in 1992, 1993 and 1994 (for the last 3 years) are as described below table.

	1992	1993	1994
Established & Unestablished Staff	F$1,182,100	F$1,219,500	F$1,262,000
Maintenance & Operations	F$ 51,500	F$ 54,700	F$ 54,700
Purchase of Goods & Services	F$ 74,700	F$ 78,500	F$ 78,500
Travel & Communications	F$ 23,400	F$ 22,700	F$ 147,200
Others (including Water & Electricity Supply Charge, etc.)	F$ 213,400	F$ 219,000	F$ 219,000
Total	F$1,545,100	F$1,594,400	F$1,761,400

(1F$ = J.Yen71.19)

The Government of Fiji has largely agreed to meet capital and recuttent costs relating to the Project, as outlined in the Draft Report. The FMS budget for 1995 already contains F$100,000, under requisition, for building construction and further funds are expected to be provided from 1996 onwards to meet these costs. The GTS link to Melbourne will be made operational by middle of April, 1995 from funds already allocated for this purpose. Electricity, telephone and water charges for the Department are borne by CAAF which receives an annual Government grant of F$200,000 for these and other services it offers like transportation, communications and technical maintenance support.

2-3-2 Plan of Operation (Activity)

The appropriate operation of the system under this Project must continuously and responsibly be carried out by the present staff of FMS. In order to operate meteorological observation and forecasting systems to be modernized and upgraded under the Project, and also to disseminate more speedily and to provide more accurate & enriching meteorological information and warnings of cyclone through GTS link and AFTN link, FMS must improve the staff's technique to operate and maintain the system (observation, forecasting, computer hardware & software, etc.), which will be indispensable for the operation of the Project and RSMC.

2-3-3 Location and Conditions of the Project Site

1. Natural conditions

The proposed construction site is located at approximately 1,500 m from the coast. It is in the premises of Nandi International Airport, and the runway is the north and west of the site. The site is a gentle slope stretching downward to northwest and southwest, and facing to the

ocean beyond the runway. There is a control tower of the airport (18 m in height) at the highest point of a hill about 250 m away to the east-northeast from the site. In the southern and northern directions, which should be clear of any obstacle for reception from NOAA data, there is nothing in sight whose angle of elevation is more than 5 ° .

Nadi belongs to the tropical oceanic climate with the annual mean temperature of 25.5 degrees and the annual rainfall of 1867mm. The monthly mean temperature changes little seasonally, the highest being 27.1 ° in January and February and the lowest, 23.5° in July, while the rainfall changes drastically from 50-60 mm/month in the dry season centering in July and August to about 300 mm/month in the rainy season mainly from January through March. In the rainy season, in particular, which is largely influenced by the South Pacific convergence zone, there is a localized torrential rain quite frequently. Moreover, cyclones often visit the area from December through March. The 100-year recurrence probability of wind velocity is 67 m/s calculated by FMS.

(Refer to "Project Site Map" and Appendix 8. "Result of Geological Investigation")

2. Conditions of Infrastructure

<Proposed Sites for Installation of Automatic Weather Observation System>
All the proposed sites are located at solitary islands and not yet established infrastructure. There is no commercial supply system at each site.
The system is to be operated on solar batter as the primary power, and to be attached an accumulator (lead acid battery) as backup.

<Proposed Site for Construction of Regional Specialized Meteorological Centre>
The conditions of infrastructure surrounding the proposed site are as follows:

1) Electricity
The supply, transmission and distribution of electricity is operated and managed by the Fiji Electricity Authority (FEA). FEA belongs to the Ministry of Lands, Mineral Resources and Energy.

Across the road in front of the site, there is FEA Power Center which is distributing 11 kV electricity to the entire part of Nandi International Airport. It is possible to take in power to the site from there. FEA will make an electric distribution plan at the period of commencement of the Project, lead wires of an appropriate capacity into the site and install a transformer. FEA is prepared with its own criteria for specifications of electrical facilities and power houses, or standards of installation of switchboards, power meters, etc. for domestic use. The construction work for the Project must follow the specifications and standards of FEA.

2) Telephone

All the telephone circuits in Fiji are operated and managed by the Fiji Post & Telecommunications Limited (FPTL).

There is an existing trunk line under the road in front of the site, and it is possible to utilize the line. To the Project site, the telephone circuit is to be connected from the trunk line, and the Private Branch Exchange (PBX) will be installed by FPTL.

At present, FPTL is striving to replace the domestic existing telecommunication link in Fiji with optical fiber system. The trunk link has already executed the replacement ahead of their schedule. And also CAAF has a plan to replace the existing telecommunication link in Nadi Airport premises with optical fiber system by 1998 which is the scheduled completion period of the Project.

3) Water supply

Water supply is operated and managed by the Public Works Department (PWD) under the Ministry of Public Works, Infrastructure and Transport.

There is a 6 inches (about 15 cm) diameter water supply pipe as main under the road in front of the site. Water supply for the Project will be from the main through 2.5 inches (about 6.5 cm) diameter water pipe, which is branched out from the main pipe. All necessary works for water intake to the site will be executed by PWD.

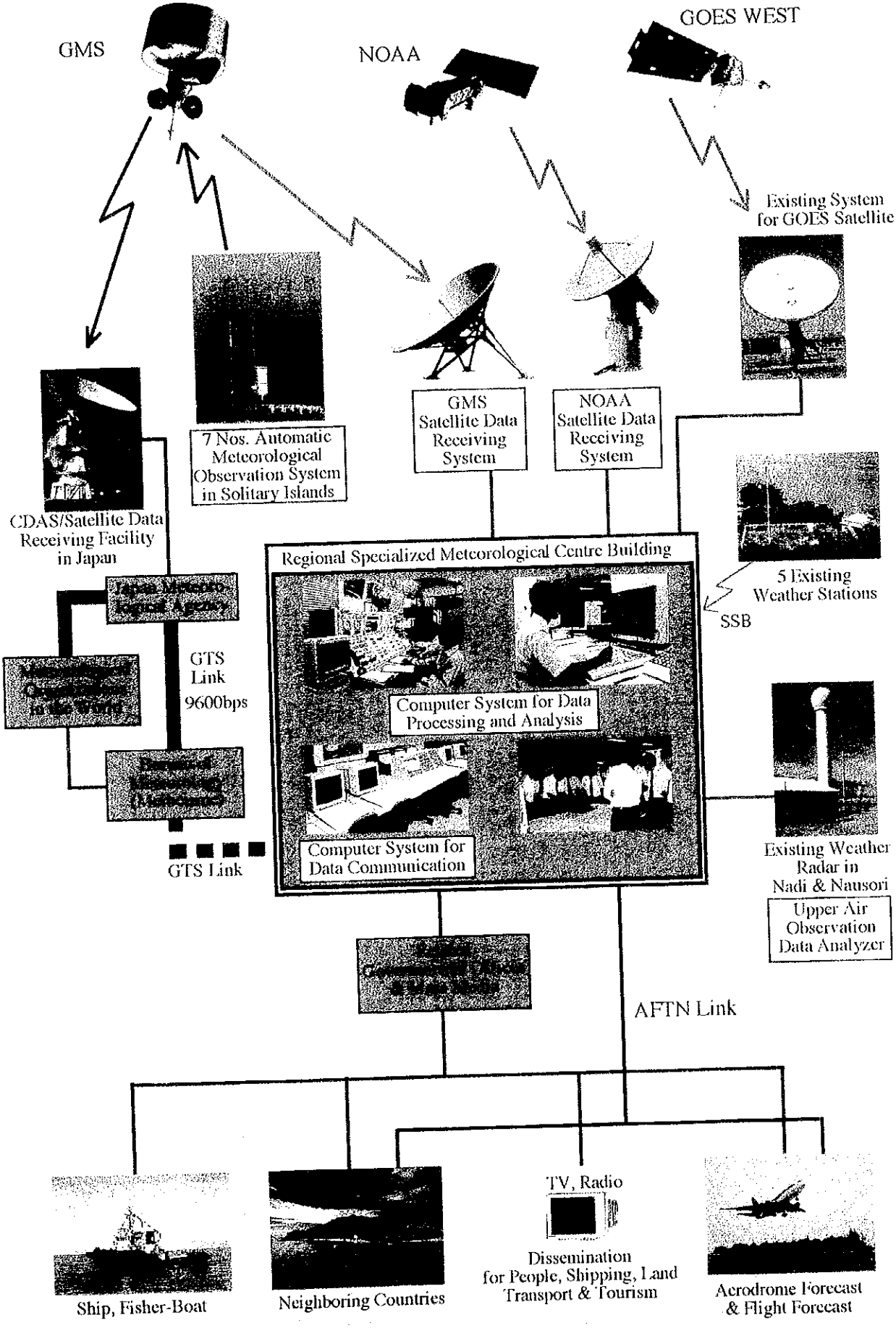
4) Sewerage

As is the case with the water supply, the sewerage is operated and managed by PWD. As mentioned earlier, however, the site is on the premises of Nandi International Airport owned by CAAF and the sewage within the premises is purified by the sewage disposal plant of CFFA. The sewer pipe has already been provided within the site, a sewer pipe under the Project will be connected to the existing pipe.

5) Drainage

There has already been a drainage installed by the CAAF in the area adjacent to the site; hence, this will be used for connection.

2-3-4 Outline of Facilities and Equipment



2-3-5 Operation and Maintenance Plan

1. Necessary Personnel, after completion of the Project

The present personnel of FMS is 88 (as of March, 1995) and it will be especially unnecessary to increase the number of staff after completion of the Project.

They are classified according to the occupational category as described below.

		Present	Future	Amendment
Director	:	1	1	
Professional staff	:	14	16	+2
Technical staff	:	67	65	−2
Administration staff	:	6	6	
	Total	88	88	

The future personnel of FMS is classified in accordance with the sectional category as follows.

Director	:	1
Climatology	:	11
Computer System	:	4
Forecasting	:	14
Observation	:	27
Reporting	:	25
Administration	:	8
	Total	88

The future organization chart of FMS is as attached herewith (Fig. 2-8).

In addition, the future personnel plan of FMS related to the forecasting and computer system to be important for the execution of the Project is as follows.

* Forecasting staff

At present, 2 Fijian forecasters are under training in New Zealand. FMS is scheduled to continue with the program of training for a forecaster in cooperation with New Zealand and Australia so that all the staff of FMS may be localized by 1998 in accordance with the localization plan of the Government of Fiji.

* Computer-related staff

- Software -

A system manager from the Information Technology and Computing Services Department of the Government of Fiji (ITC) has been assigned to FMS for the maintenance and management of software and he is expected to be a member of the staff for FMS.

For execution of the Project, furthermore, FMS has prepared a budgetary request to the Ministry of Finance and Economic Development for improvement of the computer section in FMS for data process & analysis and also assignment of new computer system engineers having professional skills in software.

Further, ITC has sufficient engineering skill and technique enough to provide software maintenance services, and the cooperation of ITC is expected to be provided to FMS after completion of the Project.

- Hardware -

The maintenance and management of the existing computer hardware at FMS is properly carried out by the engineers of CAAF, and after completion of the Project, the cooperation of CAAF is expected to be continued as the same as the present situation.

Furthermore, as activities of the private sector related to computer system, the maintenance and management of the computers belonging to the Government of Fiji is provided by the private computer enterprises in Fiji. They have sufficient engineering skills, experiences and capabilities for maintenance and management on computer hardware. The activities of the private sector will be useful for the computer system introduced under the Project.

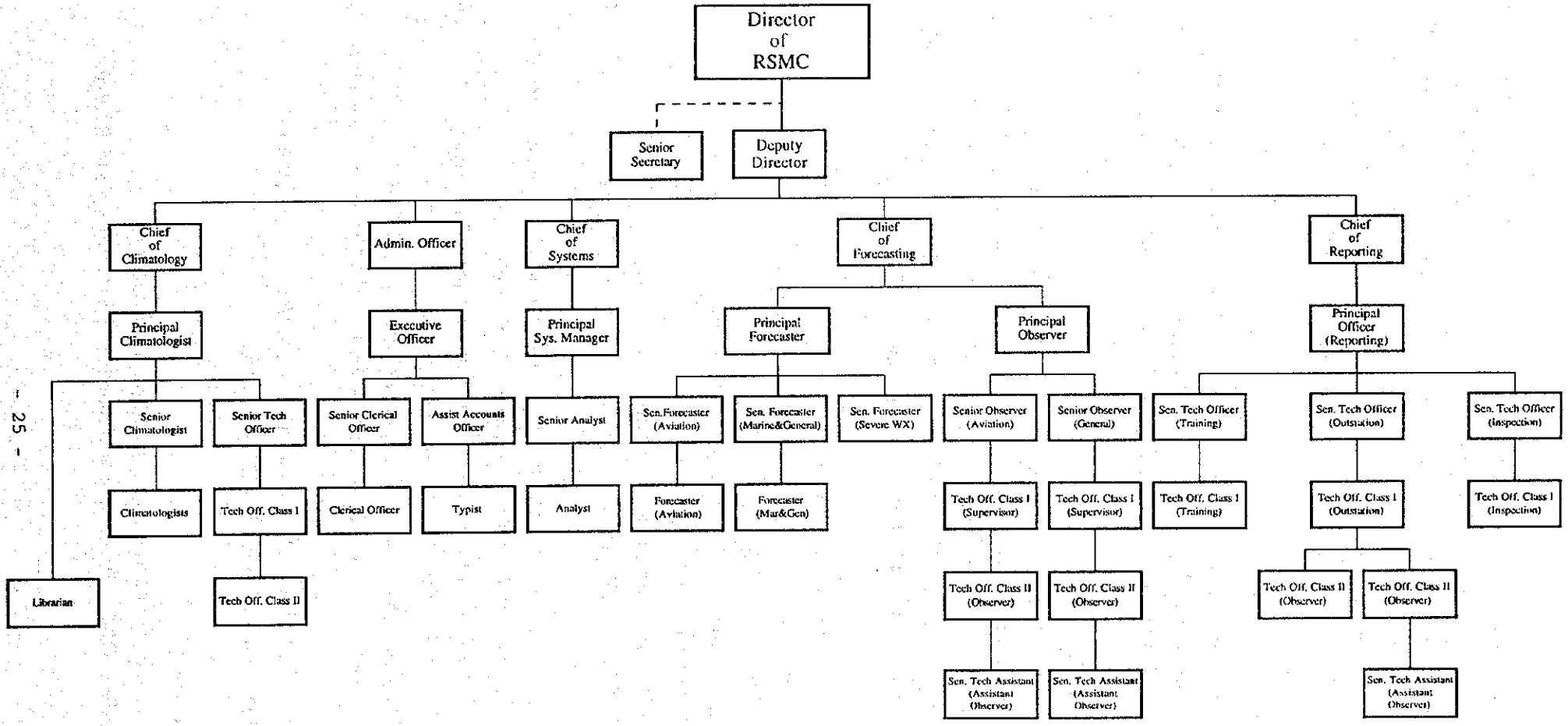


Fig. 2-8 Scheduled Organization Chart of RSMC

2. Operation and Maintenance Plan of Facilities

The maintenance of facilities will be provided mainly by the FMS associated with other organizations (Electricity Authority, Public Works Department, Post & Telecommunications Limited, and Civil Aviation Authority). In particular, the cooperation to be provided by CAAF is indispensable to the maintenance of the facility to be on the premises of Nandi International Airport and the equipment to be introduced under the Project.

<Maintenance Cost for Facilities>

After completion of the Project, FMS will take care of the expenditure for normal operation of the Regional Specialized Meteorological Centre at his expense. The necessary expenditure as water and electricity charges, etc. are calculated on base of the commercial rate as follows:

1) Water charge : F$7,000/year

Weekdays: (41 staff +5 visitors) × 120 ℓ /day × 22days= 121,440 ℓ

Saturdays & Sundays: (8 staff +1 visitor) × 120 ℓ /day × 8days=8,64 ℓ

Night time: 8 staff × 120 ℓ /day × 30days=28,800 ℓ

Total: 158,880 ℓ /month × 0.3463cent=55,020cent ÷ 100=F$550.255/month × 1.1(VAT) =F$605.805/month × 12months =F$7,270/year

2) Electricity charge:F$117,000/year

A/C(Common rooms) : Weekdays (08:00 ~ 16:30)

30kw × 0.75 × 8.5h × 18days=3,442kwh

A/C(Common rooms) : Fridays (08:00 ~ 16:00)

30kw × 0.75 × 8h × 4days=720kwh

A/C(Forecasting & observation section) : Everyday

(28kw × 0.8 × 8.5h+28kw × 0.6 × 15.5h) × 30days=13,524kwh

Lighting(31kw)·receptacle(21kw) at Common rooms : Weekdays (08:00 ~ 16:30)

(31kw × 0.7+21kw × 0.5) × 8.5h × 18days=4,926kwh

Lighting(31kw)·receptacle(21kw) at Common rooms : Fridays (08:00 ~ 16:00)

(31kw × 0.7+21kw × 0.5) × 8h × 4days=1,030kwh

Lighting·receptacle(Forecasting & observation section) : Everyday

(35kw × 0.75 × 8.5h+30kw × 0.55 × 15.5h+5kw × 0.7 × 15.5h) × 30days = 15,993kwh

39,635kwh × 22.51cent=892,183cent=F$8,921/month × 1.1(VAT) =F$9,800/month × 12months = F$117,756/year

3) Telephone charge

The telephone charge will be as the same as the present condition.

Therefore, F$925 (1994, Dec) × 12months = F$11,100 ≒ F$12,000/year

4) Traffic Charge of GTS link

FMS has already discussed with Fiji Posts & Telecommunications Limited (FPTL) about the following traffic charges. The digital facsimile system (DIFACS) donated by Australia has already installed and FMS is receiving observed and prognostic weather charts from Melbourne by DIFACS through GTS link. Accordingly, the budget for expenditure of GTS traffic charge has already been located by the Government of Fiji.

Suva～Nausori	:	F$693/month (VAT inclusive)
Suva～Nadi	:	F$1,353/month (VAT inclusive)
Suva～FINTEL	:	F$300/month (VAT inclusive)
FINTEL～Melbourne	:	F$4,180/month (VAT inclusive)

F$6,526/month × 12months = F$78,312≒F$78,000/year

3. Operation and Maintenance Plan of Equipment

Many electronic parts are used in the computerized instruments and equipment in these today. When they have developed a failure internally, there is no other alternative to repair it, only replacement of a part is useful to solve the failure.

The following methods will have to be applied to minimize the occurrence of failures.

* The power supply to rooms to be installed computer systems should be provided through CVCF devise for power distribution.
* At the time of installation work of equipment, effective operation and maintenance method and technique should be provided through on-the-job training to be executed by a contractor.
* Consideration for selection and procurement of the equipment will be necessary for utilization of local activities in the occurrence of a failure.

In particular, it is a necessity to execute 2 courses of the on-the-job training for the staff of FMS in charge of operation and maintenance. In order for each person to be able to appropriately carry out his duty without any failure, it is indispensable to have operation manuals and maintenance manuals. Thus, the on-the-job training should be conducted in accordance with these manuals, covering as many staff as possible.

<Maintenance Cost of Equipment>

The systems to be introduced under the Project will be installed at the rooms of fully equipped with air conditioning system and CVCF & UPS as a back-up for constant power supply in Regional Specialized Meteorological Centre. As the same as in Japan, the whole equipment will be installed in a suitable and effective condition for a computer system . In case of normal operation under the above such condition, the annual maintenance cost of equipment is possible to be estimated with a case of Japan in mind.

1) Repairing Cost : F$25,000.-/year (from 4th year)

On the condition of about 1 year warranty period by a contractor and supply of spare parts under the Project, the repairing cost for computer system after the completion of the Project will be;

First year : Free of charge, because of the warranty period by the contractor.
Second year : No expense due to use of the spare parts.
Third year : No expense due to use of the spare parts.
Fourth year : From this year, F$25,000 / year as the repairing cost may be necessary.

(* At the time of necessity of a manufacturer's engineer from overseas, additional cost, approximate F$15,000.-, will be required.)

2) Maintenance cost of automatic weather observation instrument : F$3,000/year

Before a cyclone season and after a cyclone season (twice a year), the maintenance for the automatic observation system will be necessary. For this purpose, the travel expenses and other necessary expenses for 2 maintenance staff will be required.

3) Cost of consumables: F$12,000.-/year

It will be necessary from the first year.

Printer paper	F$3,100.-(F$0.031×100,000 sheets)
Magnetic tape for computer	F$3,900.-(F$39×100 nos.)
Printer toner & ink ribbon	F$5,000.-(toner:F$235×15nos. & ribbon: F$1,500/year)

The total annual maintenance cost (it is including the existing expenditure) will be expected as described in the below table.

Budget for 1994	Annual Maintenance Cost	1st year	2nd year	3rd year	from 4th year
Maintenance & Operations F$54,700.	Repairing cost :	F$0.	F$0.	F$0.	F$25,000.
Purchase of Goods & Services F$78,500.	Consumables :	F$12,000.	F$12,000.	F$12,000.	F$12,000.
Travel & Communications F$147,200.	Telephone charge :	F$12,000.	F$12,000.	F$12,000.	F$12,000.
	DCP Maintenance :	F$3,000.	F$3,000.	F$3,000.	F$3,000.
Others (including Water & & Electricity Supply Charge, etc.) F$219,000.	Water charge :	F$7,000.	F$7,000.	F$7,000.	F$7,000.
	Electricity charge :	F$117,000.	F$117,000.	F$117,000.	F$117,000.
	Traffic charge (GTS):	F$58,000.	F$66,000.	F$74,000.	F$78,000.
Sum of Budget for 1994 F$1,761,400.	Total	F$209,000.	F$217,000.	F$225,000.	F$254,000.

The whole annual maintenance cost as mentioned above will not be as additional expenses of FMS. Because FMS is taking care of water charge, electricity charge, telephone charge and traffic charge for the existing buildings (FMS Hq. & Forecasting centre in Nadi) at the present.
The present expenditure of 1995 is approximately F$111,000.
(water charge:F$4,000., electricity charge:F$37,000., telephone charge:F$12,000. and traffic charge:F$58,000.)
Minimization of an annual maintenance cost for FMS has been considered in the basic design study, nevertheless the repairing cost, consumables and DCP maintenance cost will additionally be needed for normal operation of all equipment under the Project.

In order to minimize the operation and maintenance cost, it is necessary that all staff of FMS must have the spacial consideration for minimization of consumption and execute the economizing. It is the best method minimization of the operation and maintenance cost.

・Additional Maintenance Cost due to the Project

In consequence of the above conditions, the annual maintenance cost for the Project as described in the below table will be needed additionally.

Budget for 1994	Additional Maintenance Cost				
		1st year	2nd year	3rd year	from 4th year
Maintenance & Operations F$54,700.	Repairing cost :	F$0.	F$0.	F$0.	F$25,000.
Purchase of Goods & Services F$78,500.	Consumables :	F$12,000.	F$12,000.	F$12,000.	F$12,000.
Travel & Communications F$147,200.	DCP Maintenance :	F$3,000.	F$3,000.	F$3,000.	F$3,000.
Others (including Water & & Electricity Supply Charge, etc.) F$297,000.	Water charge :	F$3,000.	F$3,000.	F$3,000.	F$3,000.
	Electricity charge :	F$80,000.	F$80,000.	F$80,000.	F$80,000.
Sum of Budget for 1994 F$1,761,400.	Total	F$98,000.	F$98,000.	F$98,000.	F$123,000.

The additional maintenance cost (from 4th year) after completion of the Project, it will be approximately 7% of the sum of budget for 1994. Therefore, it is not expected any problem for proper operation and maintenance.

2-4 Technical Cooperation

In the application of the request from the Government of Fiji, the following technical cooperation has been requested.

・ Short-term experts

Engineer for computer operation : 1

Engineer for satellite data analysis : 1

During the discussion with the Government of Fiji on the basic design study in Fiji, the request for the following training under Japan's technical cooperation has been expressed by FMS for the execution of proper operation and maintenance.

Training for Operation and Maintenance

for the Computer Hardware : 1 person (training term : 6 months)

for the Computer Software : 1 person (training term : 6 months)

Chapter 3. Basic Design

Chapter 3 Basic Design

3-1 Design Policy

1. Basic Design Policy of Equipment
The basic design policy of the function and performance of the equipment is as follows.

1) To be capable of carrying out the five meteorological active components (observation, telecommunication, data processing and analysis, forecasting and dissemination) in an appropriate and effective manner as RSMC .

2) To be capable of performing all necessary meteorological services and the role of RSMC in the around-the-clock operation.

3) To be capable of enough ability of providing meteorological data and information as a leading meteorological service organization in the South Pacific Region in the around-the-clock.

4) To be capable of supplying weather forecast and warning uninterruptedly even during tropical cyclones, the equipment is to be sufficiently reliable with adequate countermeasures taken against natural disasters.

The basic design policy of the individual equipment is described below.

a. Computer System for Data Communication, Processing and Analysis
For GTS data exchange between Nadi (FMS) and Melbourne (Bureau of Meteorology, Australia), the computer system is to be designed so as to be suitable for interfacing with, and also to enable monitoring in, Melbourne.

Both the hardware and software of the computer system are to be designed so that the on-site maintenance is performed easily. The design is to be based on the present and future maintenance conditions in Fiji and in adequate consideration of simplicity of operation and durability.

b. Satellite Image Receiving System
The components are as follows:

For GMS : 1 set
For NOAA: 1 set

In the design, compatibility with the existing equipment, simplicity of operation and durability are to be adequately taken into account.

Respective equipment is to be connected with LAN within the facility by Ethernet, and the equipment is to be attached with an image printing function.

c. Automatic Meteorological Observation Equipment (DCP)

Based on the results of the investigation and study stated before, seven installation sites were selected out of a total of 11 sites requested by Fiji. Because of the difficulty in accessibility for most of the sites, this equipment is to be designed along with the following policies.

・To make the structure sufficiently resistant to the tropical cyclones with the allowable wind velocity of 67 m/s (100-year recurrence probability wind velocity in Nadi).

・Due to the lack of commercial power, or low reliability at the proposed installation sites, the equipment is to be operated with solar battery as the primary power, and designed to be backed up by lead acid battery in bad weather or at night.

・Instrument and facility should have enough reliability to be maintained only twice a year.

d. Upper Air Observation Data Receiving and Analyzing Equipment

The equipment is to be designed as an automatic system making best use of the equipment and materials currently employed.

e. Meteorological Observation Instrument

One set of wind vane & anemometer is to be installed on the roof of the new building. The instrument is to be designed for remote observation and to be made sufficiently resistant to the tropical cyclones.

The calibration equipment of the meteorological observation instruments is to be designed in consideration of the use for the calibration service of a common type of instruments in Fiji and the neighboring countries. The simplicity of operation and durability are to be adequately taken into account.

The equipment is listed below.

Barometer calibration chamber: 1 set

Thermometer/hygrometer calibration chamber/Thermometer calibration water tank: 1 set each

Wind vane and anemometer test equipment: 1 set

2. Basic Design Policy of theBuilding

1) Building Plan: "Regional Specialized Meteorological Centre"

The design policy is to make building and facility plans for the implementation of services as the "Regional Specialized Meteorological Centre" of the meteorological services in the South

West Pacific area in the future plan of FMS, and for appropriate and effective services and operation, and accommodation of the staff, systems and facilities.

The basic design policy is to design the Centre incorporating the following 8 functions:

a. To be capable of carrying out the five meteorological active ocmpornents in an appropriate and effective way: observation, telecommunication, data processing and analysis, forecasting and dessemination.

b. To be capable of carrying out various meteorological services as the "Regional Specialized Meteorological Centre."

c. To provide an environment where services may be performed effectively and efficiently in accordance with the flow of the meteorological services.

d. To be capable of responding to the service curriculum, with forecasting and observation departments on 24 hour shifts.

e. To be provided with installations and equipment suitable for the meteorological services of 24 hour shifts, every day, all year around (Uninterrupted Power Supply system and Constant Frequency and Constant Voltage equipment, etc.).

f. Having the mission of supplying uninterrupted weather forecast and warning even during tropical cyclones, the Center is to be sufficiently robust with adequate countermeasures taken against natural disasters.

g. The Centre is to be capable of adapting to the meteorological system and equipment to be installed in the Project.

h. The Centre is to be capable of adapting to the meteorological services of the Project and the accompanying staff numbers.

2) Structural Design

In order to withstanding natural disasters (especially tropical cyclones), the safe and economic structural design is to be applied, and local structural materials are selected wherever possible. Since the site is on a slope, the study is to be made based on accurate foundation investigations, for the selection of the foundation structure.

3) Installation Plan

Installations required for the round the clock operation throughout the year, and the executions of uninterrupted forecasting and warning even during the tropical cyclones, are to be planned. The equipment system is to be selected from the viewpoint of easy operation and maintenance, taking safety and economy into consideration.

4) Construction Plan

By using the materials available in Fiji and applying local construction methods, an appropriate and economic construction plan is to be established.

5) Reduction of Operation, Maintenance and Administration Cost

The size and grade of the Centre are to be appropriately established, so as not to incur excess burden, in terms of technology and economy for the operation and maintenance of FMS, after completion of the Project. Therefore, the construction materials and equipment of high durability and reasonable cost that are readily available in Fiji, are to be selected as far as possible.

6) Laws and Regulations

The National Building Code of Fiji is based on Australian Standards (AS) and New Zealand Standards (NZS). Therefore it is necessary to prepare the basic design according to this code.

3-2 Study and Examination of Design Criteria

Prior to the establishment of the basic plan, the design criteria for the equipment and facility are to be studied and examined.

1. Study of equipment design criteria

Basic design criteria to establish the specifications of equipment are to be examined as below.

1) Computer System for Meteorological Data Communication, Processing and Analysis

Hardware

(Computer)

a. To be able to communicate with the most suitable protocol for GTS data reception and transmission.

b. To have the function of AFTN Link reception and transmission, and the relay.

c. All the computers and equipment newly installed are to be connected by LAN, and able to exchange data and intercommunicate one another.

d. The connection between each computer is to be duplicated.

e. The display, disk, memory and each board are to be of common standard, and mutually interchangeable.

(Peripheral equipment)

a. Plotter: capable of plotting on paper of A0 to A4 size.

b. Scanner: corresponding to A3 size (small size weather chart).

(Common items)

a. Consumable, etc., of each piece of equipment are to be readily available in Fiji.

Software

The following software is to be installed:

a. GTS communication control and data identification software

The software includes the following functions:

- Data receiving
- Received data processing
- Message identification and processing
- Formatting and sorting
- Selection and editing
- Output processing
- Message transmission
- Pre-processing for weather chart plotting
- Urgent report processing
- Operation processing
- Off-line services

b. AFTN software: to have the same functions as GTS software.

c. Weather chart plotting software: to plot the observation data received by GTS and AFTN software and stored in a file, on blank weather chart in a standard form.

d. Image processing software: software for forecast support by displaying and analyzing the satellite images, observation data, facsimile weather charts, etc.

Fundamental software for modification to meet the demand of the system to be installed under the Project is to be procured by FMS in advance of commencement of contractor's work. Australia and New Zealand are ready to provide these software for FMS. Regarding the communication software for GTS linked with Melbourne, the software developed by Bureau of Meteorology, Australia is to be applied for FMS because of easiness in computer interface.

2) Meteorological Satellite Data Receiving System

(GMS image receiving equipment)

a. To be able to receive the high resolution (S-VISSR) data.

b. To respond to GMS-5.

c. To be able to receive clearly in Fiji (latitude 17° S, longitude 180° E).

d. To apply the allowable wind velocity of 67 m/s.

e. To be suitable for connection to LAN in FMS and data transmittion by Ethernet.

f. To have an image printing function.

(NOAA image receiving equipment)

a. To be able to receive HRPT data.

b. To be able to receive clearly in Fiji (lat. 17° S, long. 180° E)

c. To apply the allowable wind velocity of 67 m/s.

d. To be suitable for connection to LAN in FMS and data transmittion by Ethernet.

e. To have an image printing function.

3) Automatic Weather Observation Equipment

In consideration of the plan to replace the WMO registered Synoptic Station with DCP, so to ensure continuity of the data, the following five observation elements were employed and the observation is to be carried out in accordance with WMO standard.

a. Atmospheric pressure (including pressure tendency)
b. Temperature
c. Dew point temperature, or relative humidity
d. Wind direction and wind velocity
e. Rainfall

4) Upper Air Observation Data Receiving and Analyzing Equipment

To carry out the upper-air observation and analysis automatically, utilizing the radiosonde tracking signal from existing radar with wind finding function and the observed data received from radiosonde transmitter (Vaisala, RS-80 type).

5) Wind vane and Anemometer

For remote observation complying with WMO standards.

6) Calibration Equipment for Meteorological Instruments

· Barometer calibration chamber: complying with WMO standards. Provided with a standard mercury barometer.

· Thermometer/hygrometer calibration chamber of constant temperature and constant humidity / Thermometer calibration water tank: complying with WMO standards. Must be sufficient to calibrate straight type thermometers, self-recording thermometers, and self-recording hygrometers.

· Wind vane and anemometer test equipment: Capable of measuring the revolution speed of anemometer, and capable of checking the output of the wind vane.

2. Study on Design Criteria of the Building

The following design criteria shall be studied for the facility and installation planning.

1) Facility Planning (Study on the scale required for RSMC).

The plan of RSMC is to provide the space necessary for the efficient activities of the staff, and to study the scale of the facility to allow appropriate and efficient operation, and accommodation of new and existing systems and equipment.

The suitable scale of the facility is estimated through the functions and role as RSMC, staff planning for the execution of the meteorological services, system plan, and equipment plan.

The current conditions in FMS (existing systems, equipment, work space, etc.) are to be examined, because the existing systems and equipment are also to be installed in the Centre. Then, the number of rooms and floor area required for the Centre are to be determined, with respect to accommodating the administration system, staff, system, equipment and work space required by the Project.

To calculate the electrical power consumption of the whole facility, the electrical power consumption of the system plan, the system and equipment set up by the equipment plan, existing system and equipment, proposed general lighting of the Centre, installed equipment (air conditioning, etc.) must be allowed for.

In addition, for the calculation of the size of air-conditioning, the system, type and capacity of air conditioning shall be decided after calculation of the calorific value of the staff, new and existing systems and equipment, lighting, and the other items.

The electric power installation provides power round the clock, throughout the year. The introduction of a power failure proof system and power generating system to carry out uninterrupted forecast and warning even during the tropical cyclones and the installation capable of adequate operation of the system, equipment, etc., shall be studied.

The construction site proposed for the Project Centre, is located within the premises of Nadi International Airport. The relation of the proposed facility of the Project and the satellite data receiving antenna with the existing facilities, especially with the airport facilities, control tower telecommunication and radio installation in the Airport, underground wiring, and approach and departure way, shall be studied carefully and in detail.

3-3 Basic Plan

3-3-1 Site and Layout Plan

The building for this project will be constructed in the southern part of the site to avoid the direct line of sight between the airport control tower and the runway. The building will be a two story building constructed at a low point on the site taking into account the required height of the antenna to be erected on the roof to receive satellite transmissions.

To enable ready access to the building from the road, and to reduce to a minimum the costs, to be borne by the Fiji side, involved in running electricity, telephone, water supply, and drainage lines to the building, the building is planned to be positioned close to the road at the plot boundary.