

Ministry of Communications, Works and Energy  
Republic of Fiji

**BASIC DESIGN STUDY REPORT  
ON  
THE PROJECT FOR UPGRADE OF  
USPNET COMMUNICATIONS SYSTEM  
IN  
THE REPUBLIC OF FIJI**

**MARCH 1998**

JICA LIBRARY



J 1142944 (6)

**Japan International Cooperation Agency  
KDD Engineering and Consulting, Inc.**

G R T
CR (3)
98-044







**Ministry of Communications, Works and Energy  
Republic of Fiji**

**BASIC DESIGN STUDY REPORT  
ON  
THE PROJECT FOR UPGRADE OF  
USPNET COMMUNICATIONS SYSTEM  
IN  
THE REPUBLIC OF FIJI**

**MARCH 1998**

**Japan International Cooperation Agency  
KDD Engineering and Consulting, Inc.**



1142944 (6)

## 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 Upgrade of USPNet Communications System" and entrusted the study to the Japan International Cooperation Agency (JICA).


JICA sent to Fiji a study team from September 20 to October 23, 1997.

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 basic design, 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.

March 20, 1997

A handwritten signature in black ink, reading "Kimio Fujita", written in a cursive style. The signature is positioned above a horizontal line.

Kimio Fujita

President

Japan International Cooperation Agency

March 1997

Letter of Transmittal

We are pleased to submit you the basic design study report on " the Project for Upgrade of USPNet Communications System" in the Republic of Fiji.

This study was conducted by KDD Engineering and Consulting, Inc., under a contract to JICA, during the period from September 8, 1997 to March 20, 1998. 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.

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

Very truly yours,

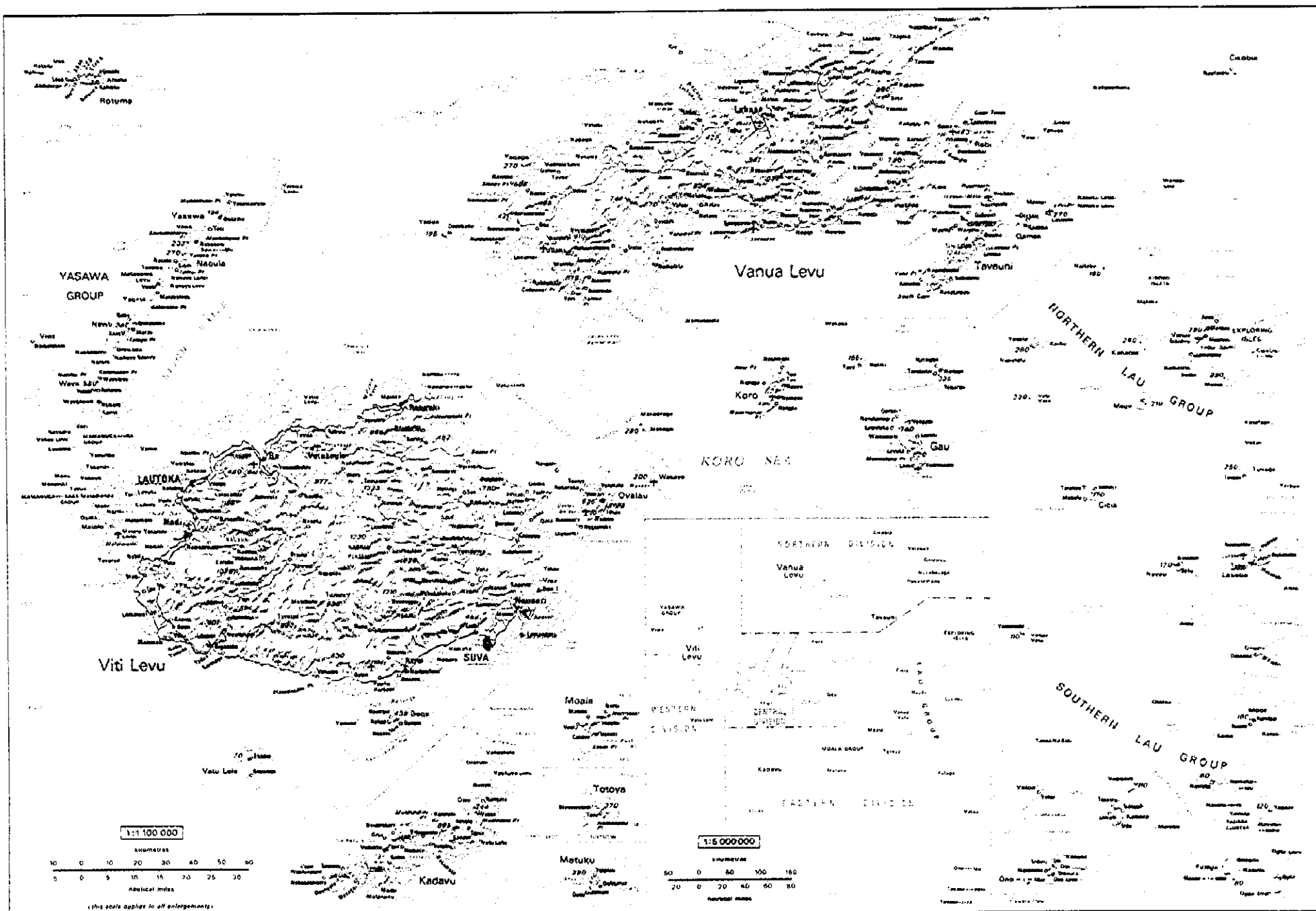
A handwritten signature in black ink, appearing to read "Katsumi Yamamoto", is written over a horizontal line.

Katsumi Yamamoto

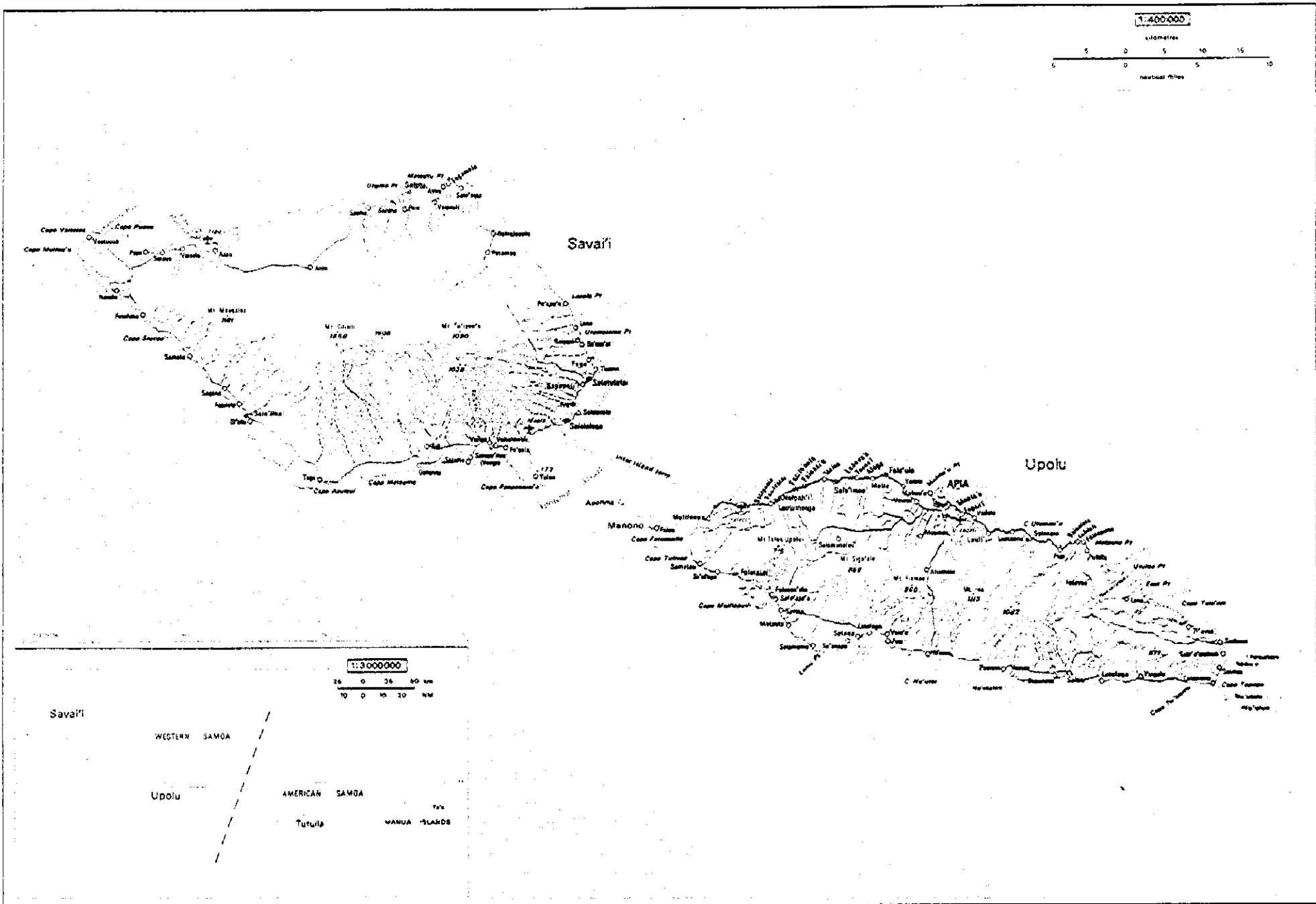
Project manager,  
Basic design study team on  
The project for Upgrade of  
USPNet Communications System  
KDD Engineering and Consulting,  
Inc.

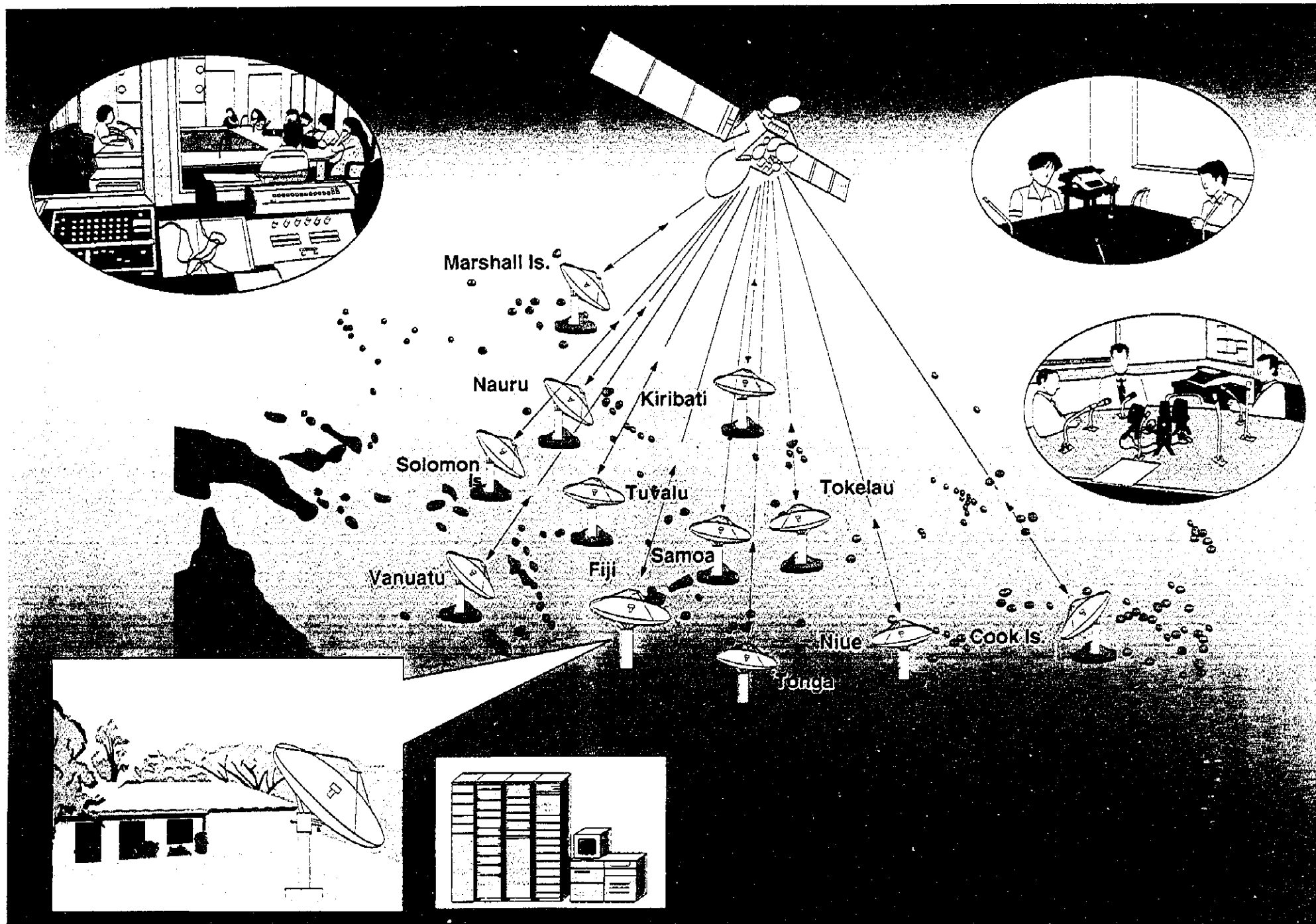


# The Republic of Fiji

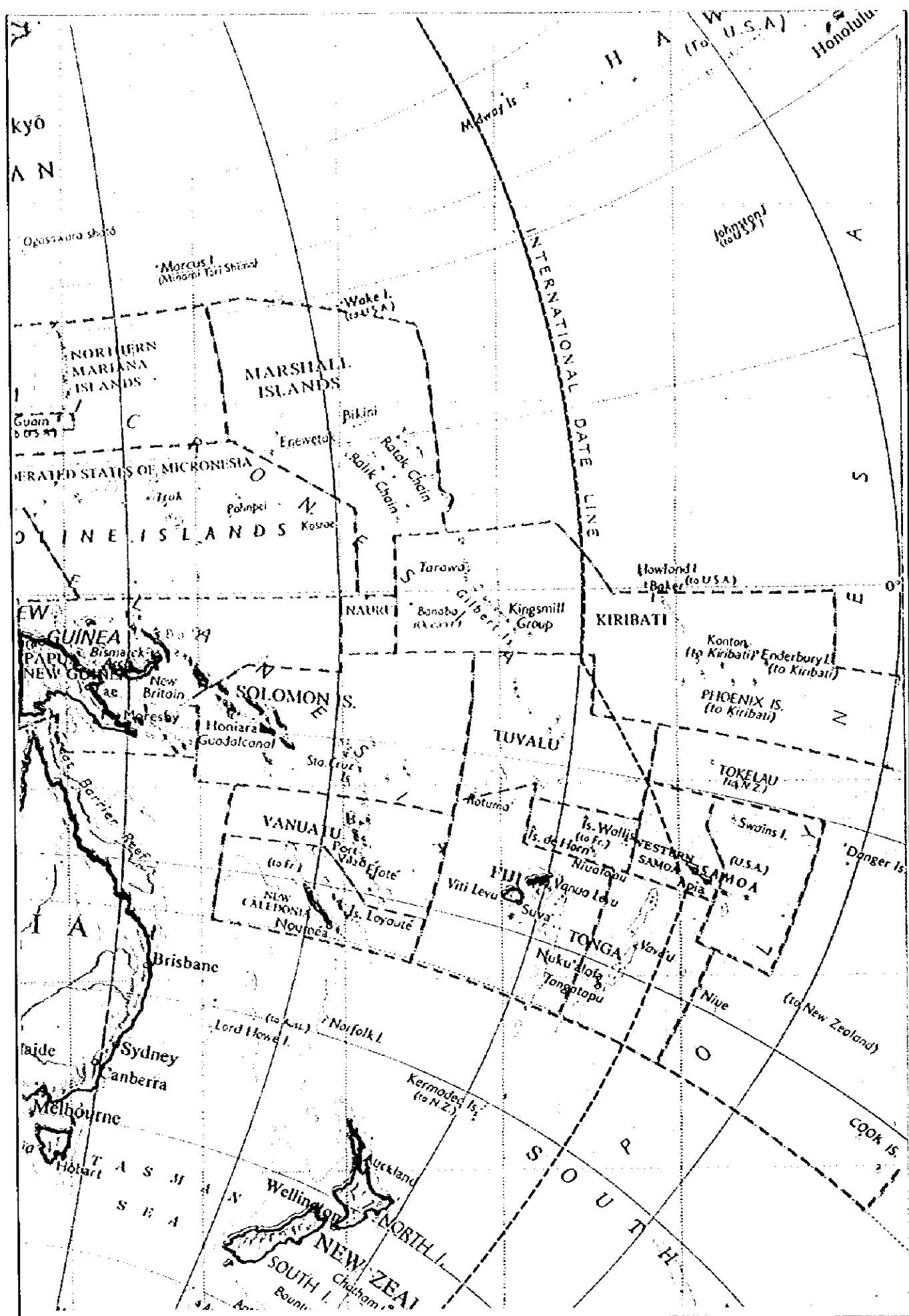


## The Independent State of Samoa

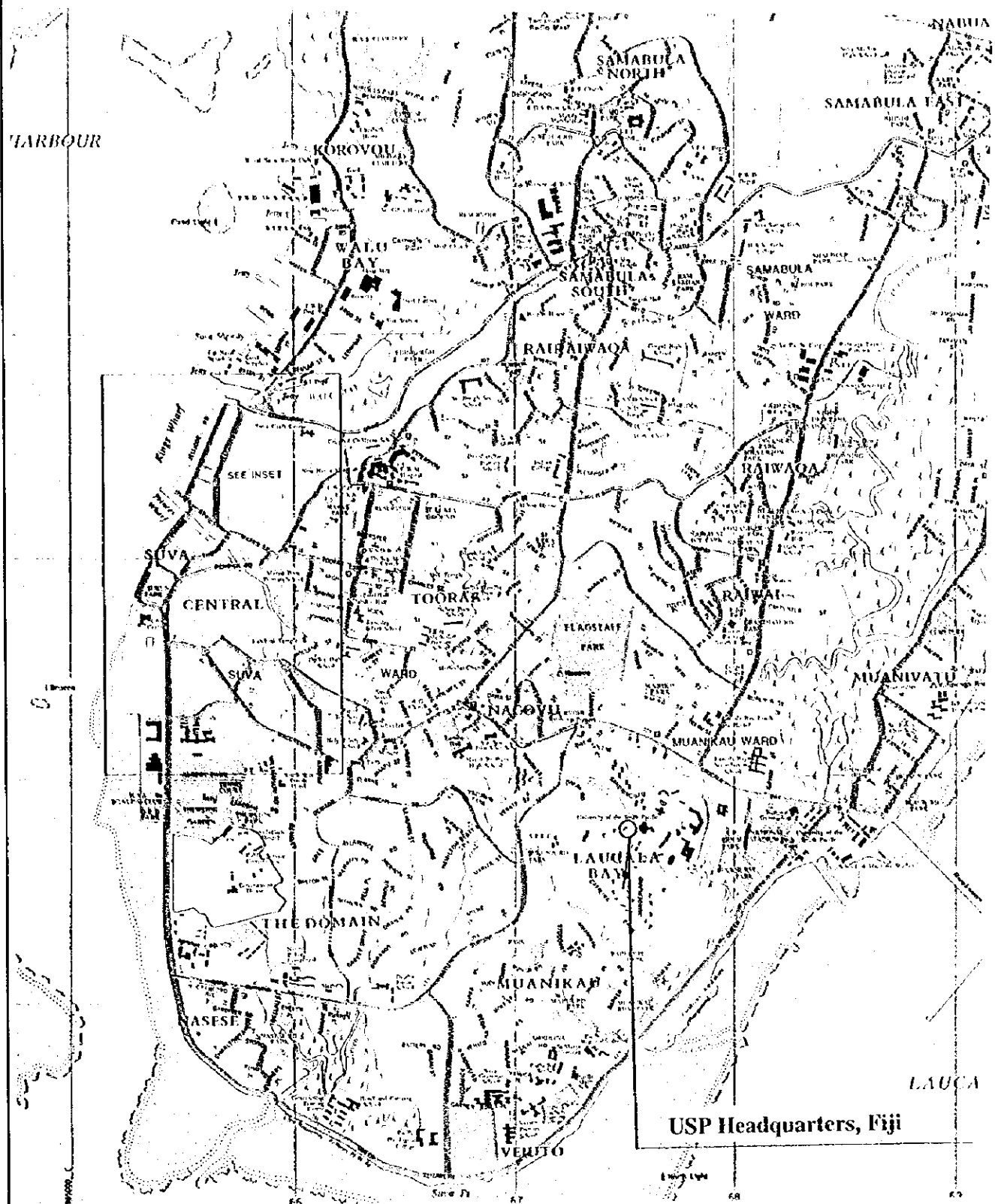




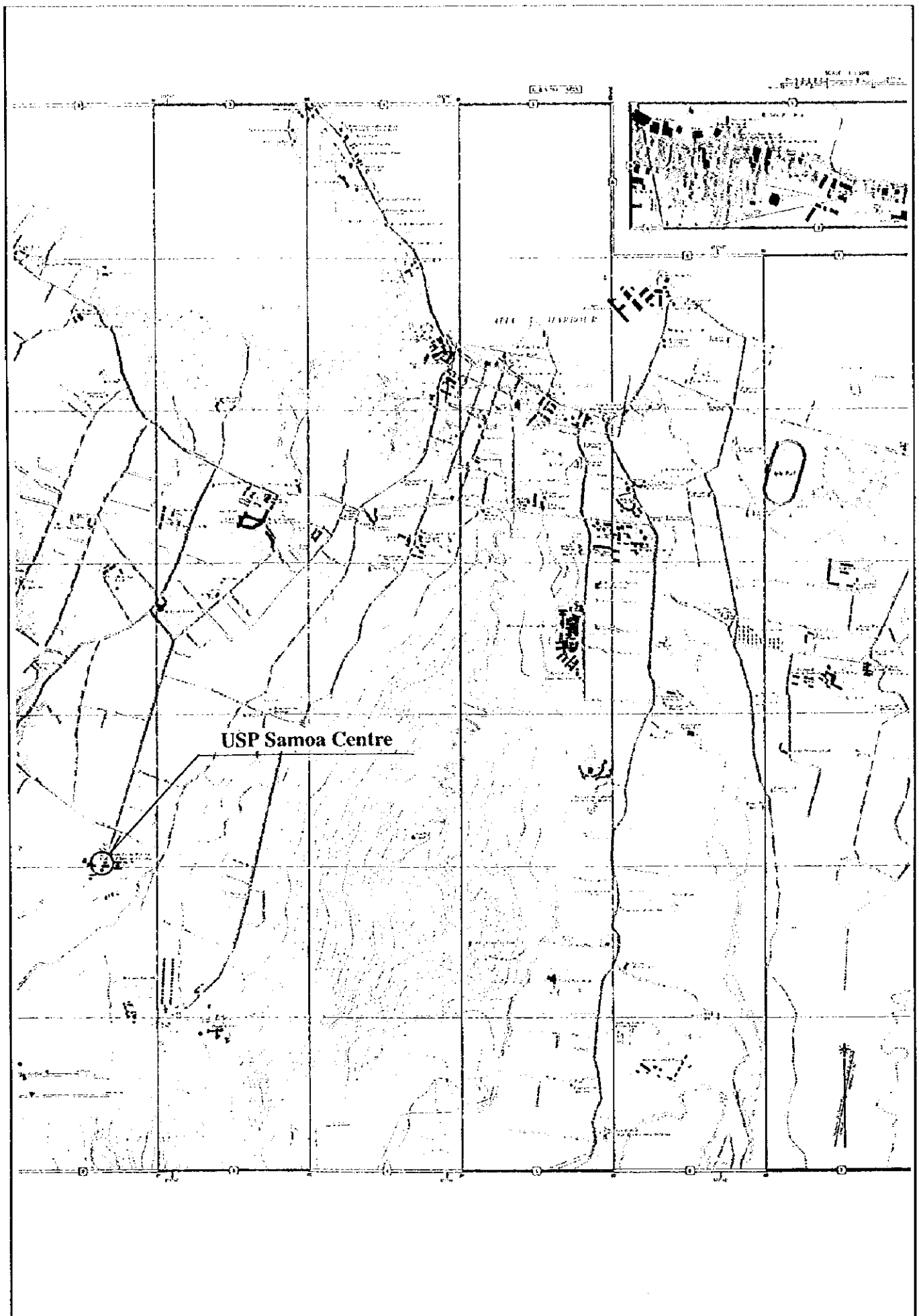
The Project for Upgrade of USPNet Communications System in The Republic of Fiji



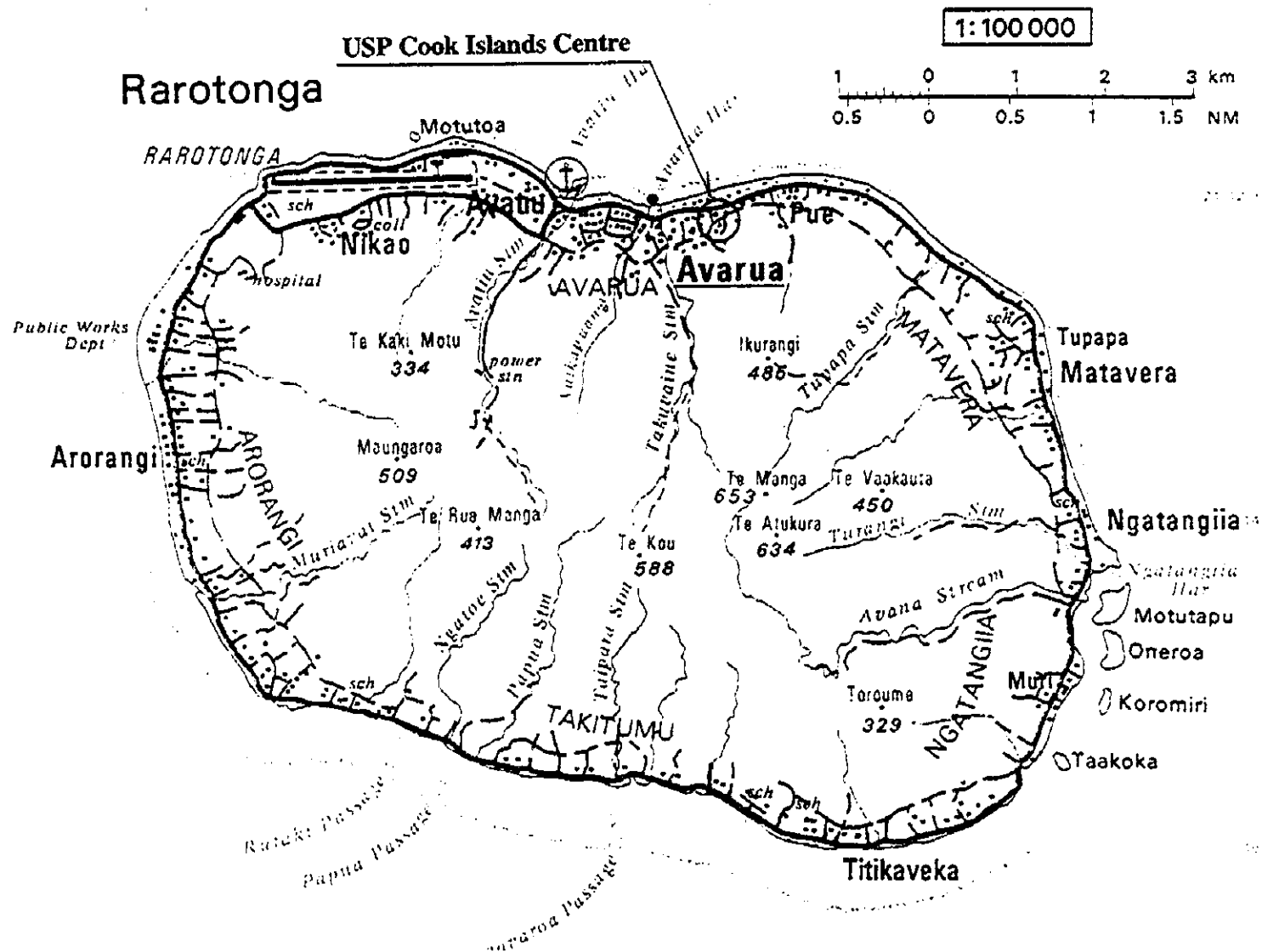
USP Member Countries and Territories

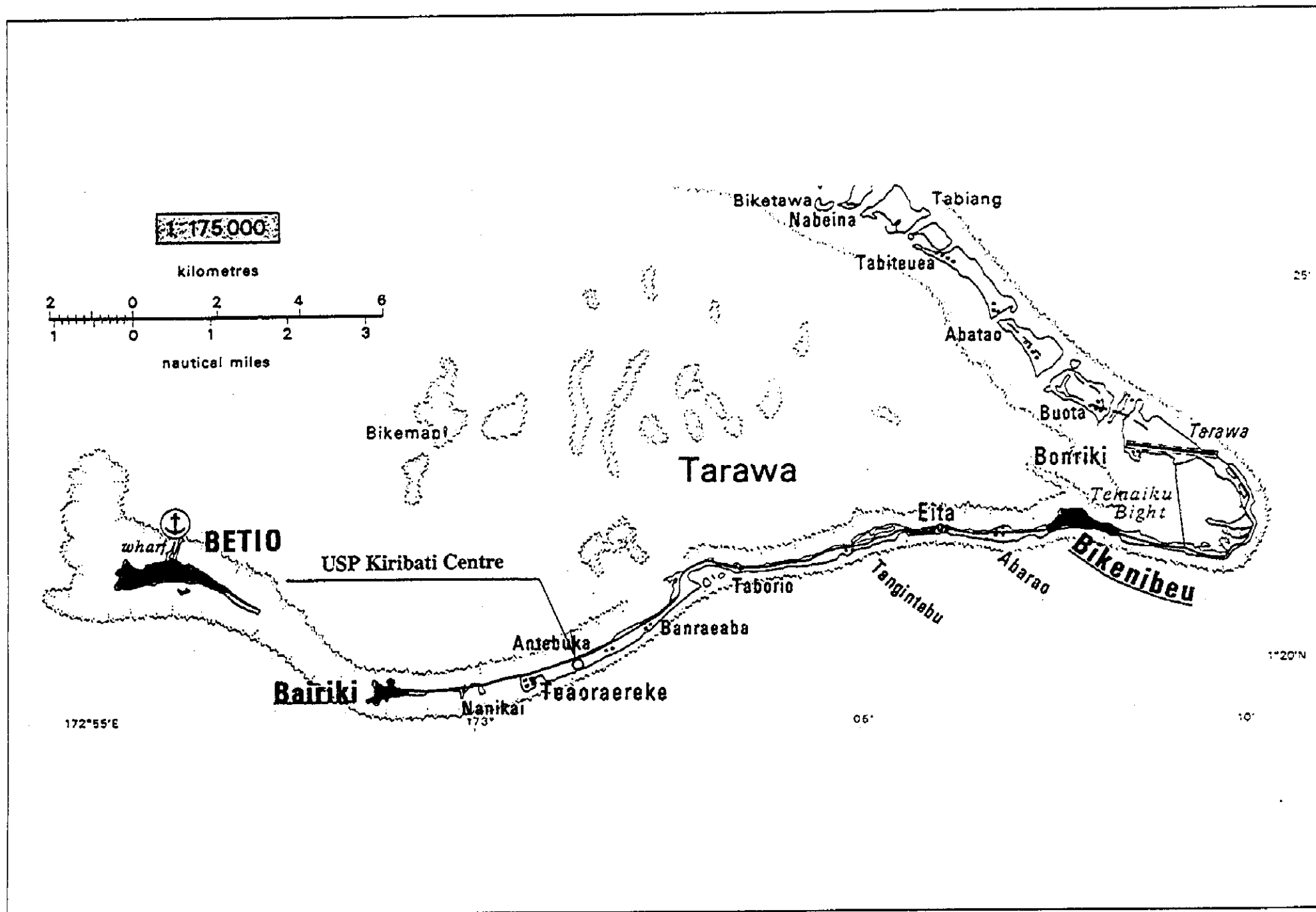


Project Site Location (Fiji)

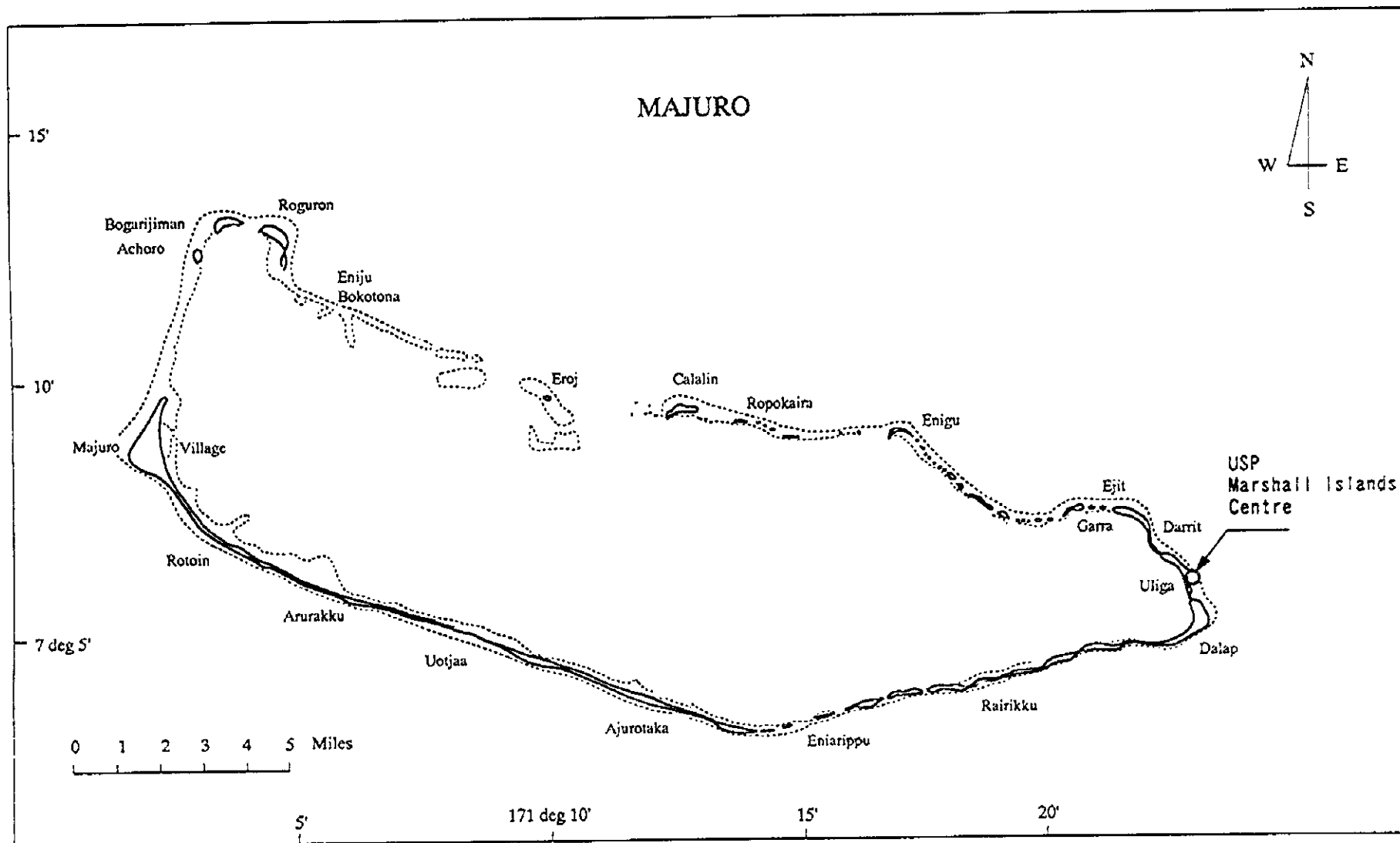


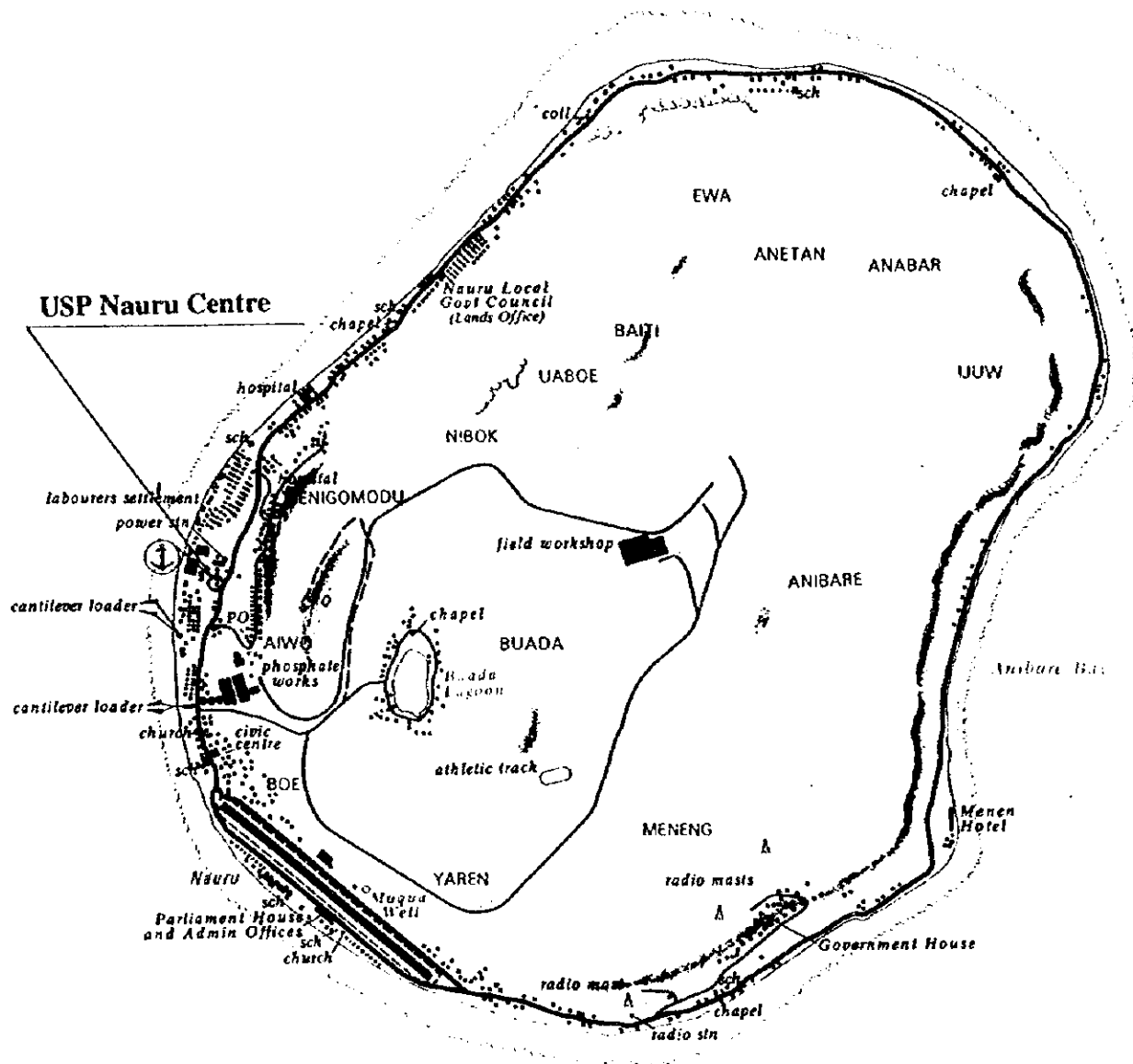
**Project Site Location (Samoa)**





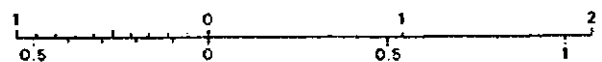






1:40 000

kilometres

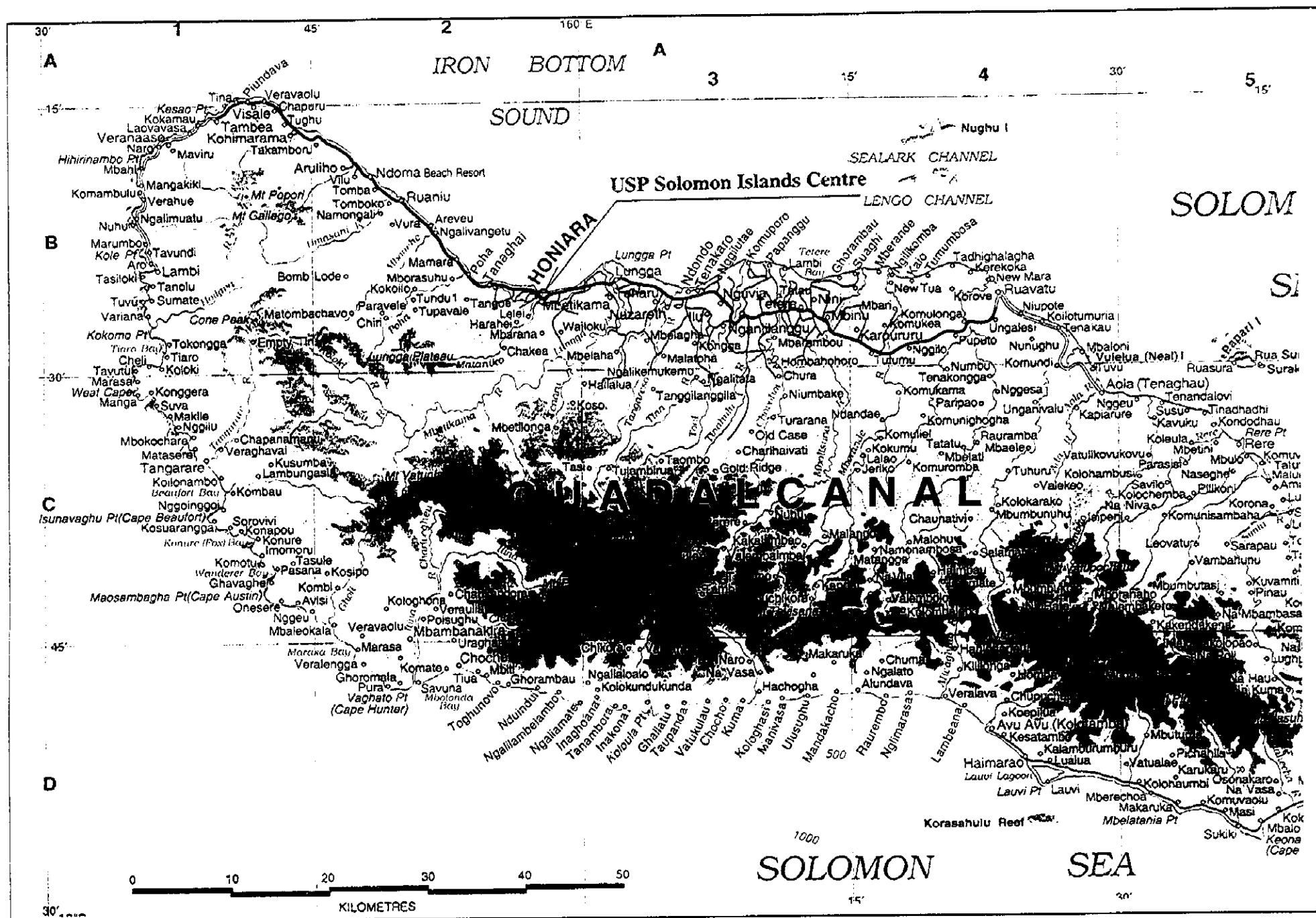


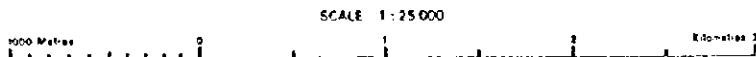
nautical miles

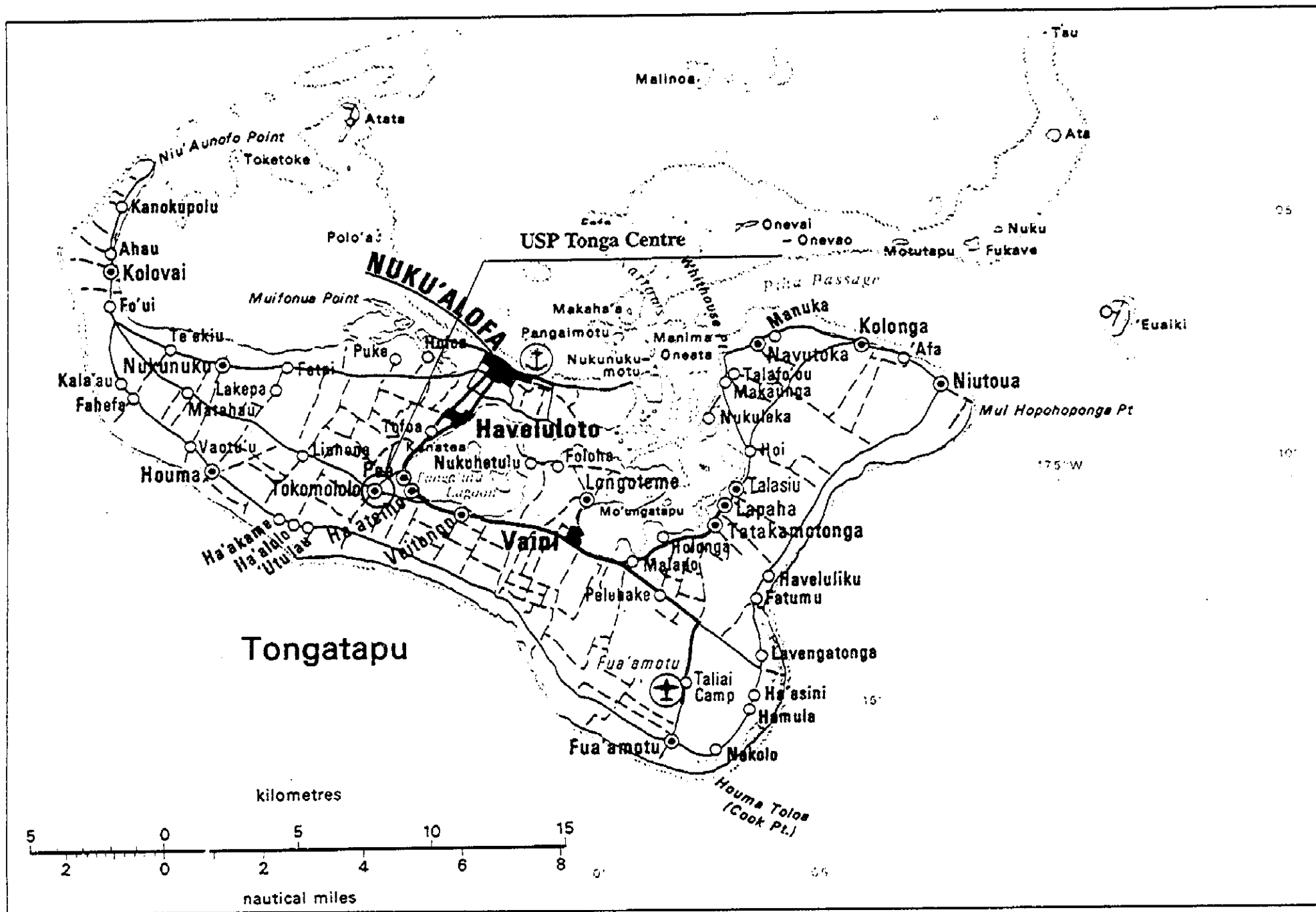
USP Nauru Centre

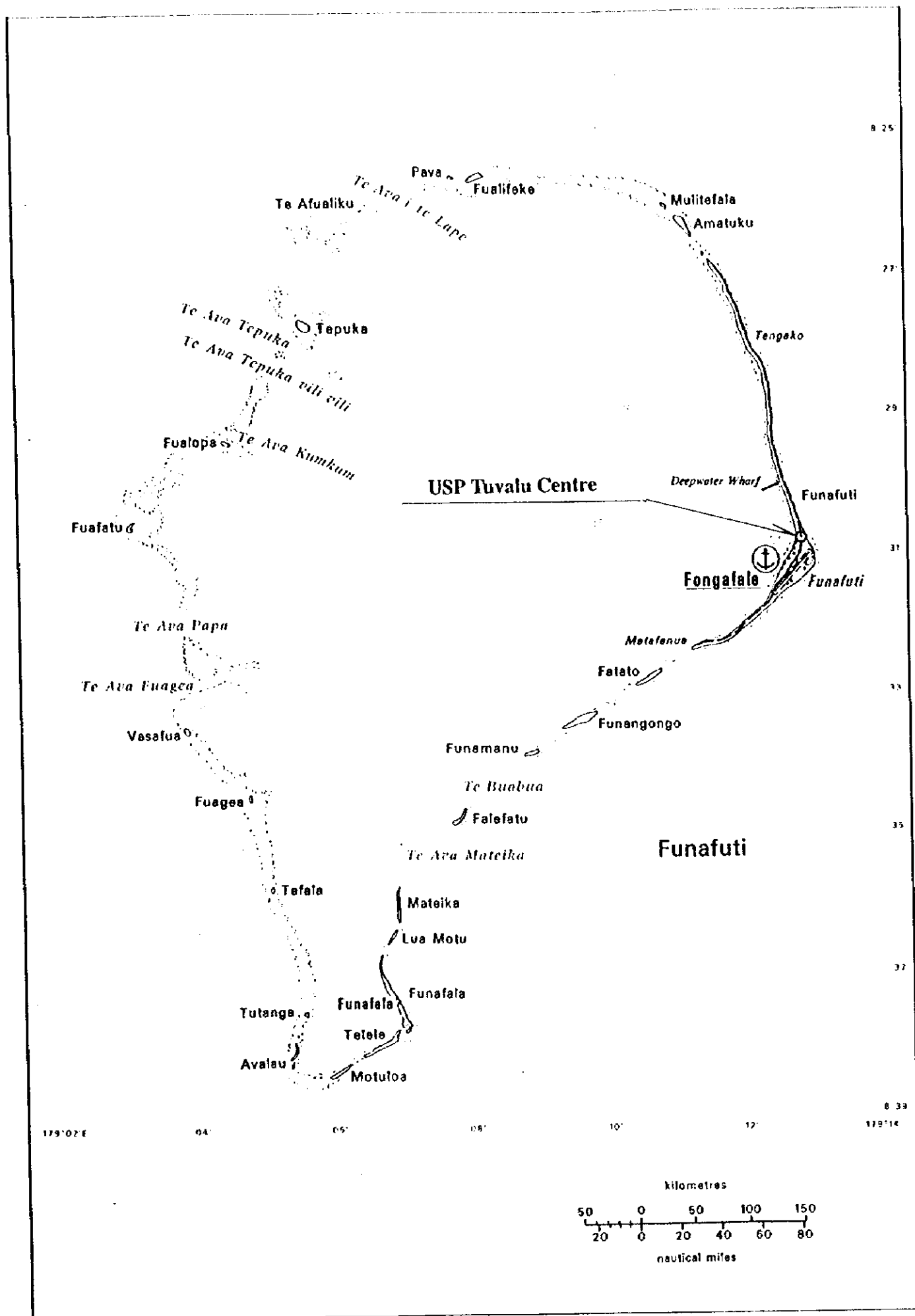


USP Niue Centre

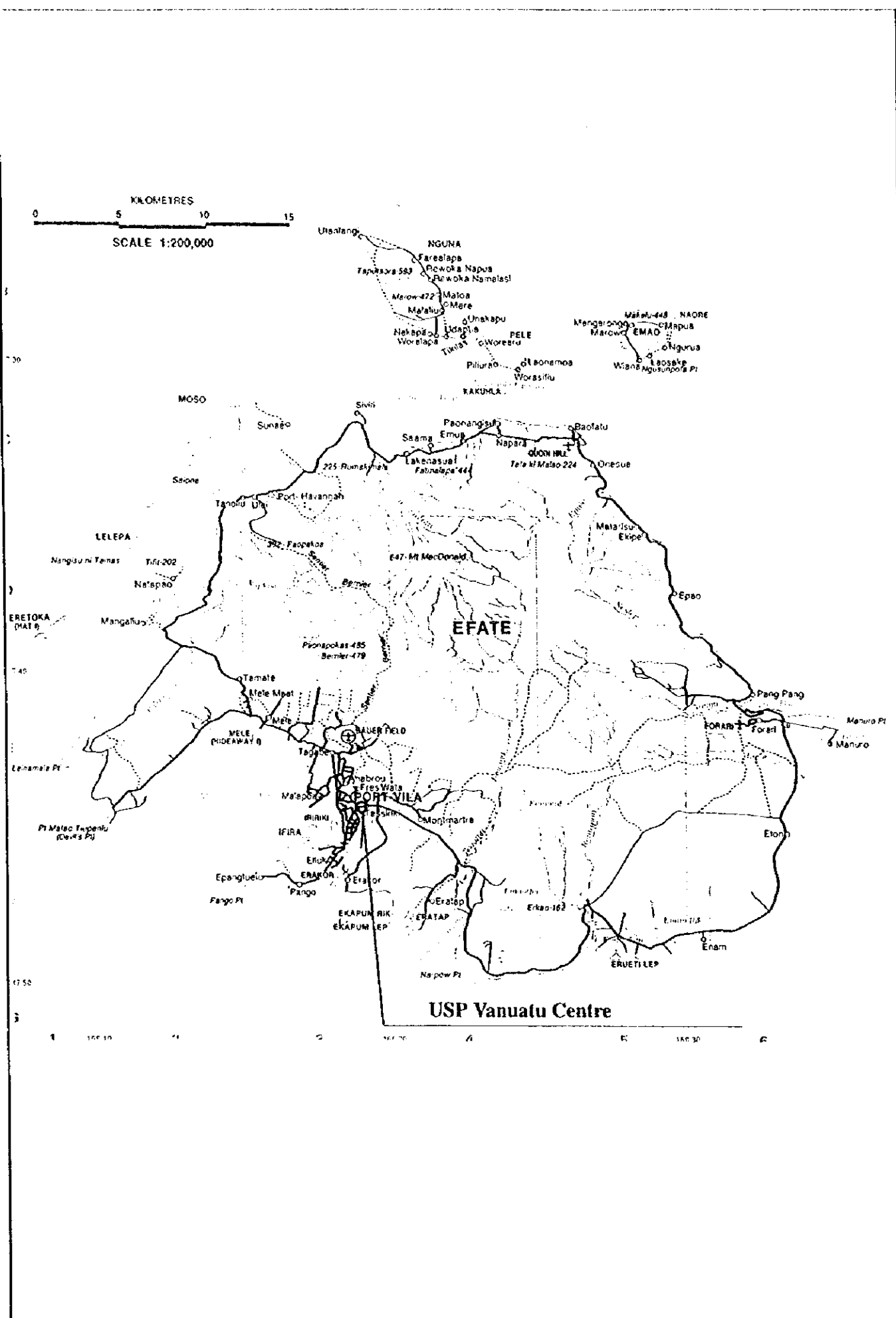


**USP Tokelau Centre****USP Tokelau Centre**

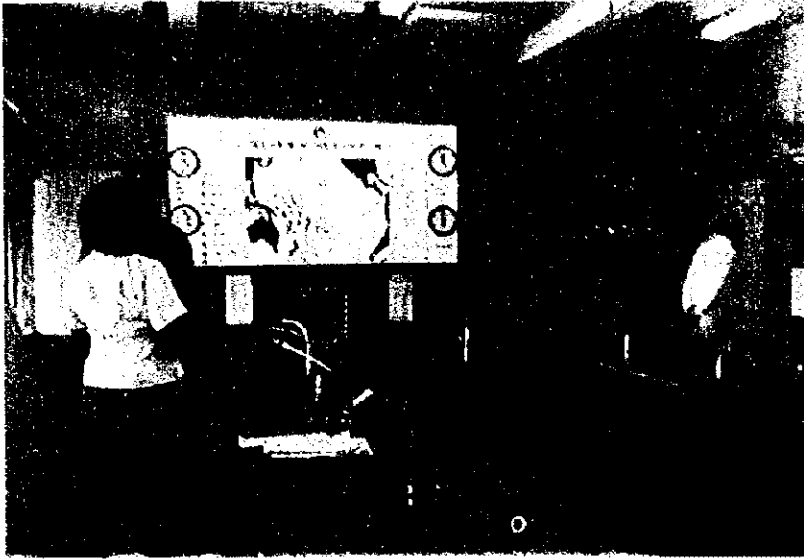




USP Tuvalu Centre







**USP Headquarters, Fiji  
(Tutorial Room)**



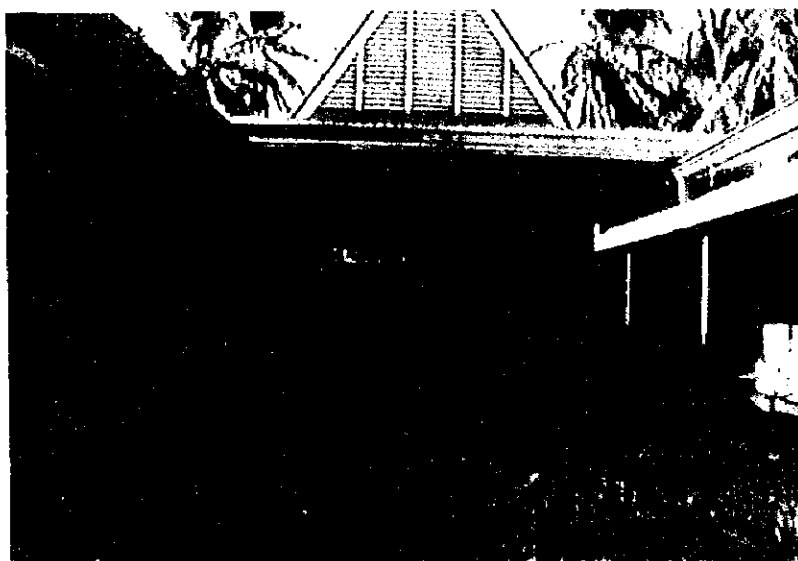
**USP Headquarters, Fiji  
(Computer Laboratory)**



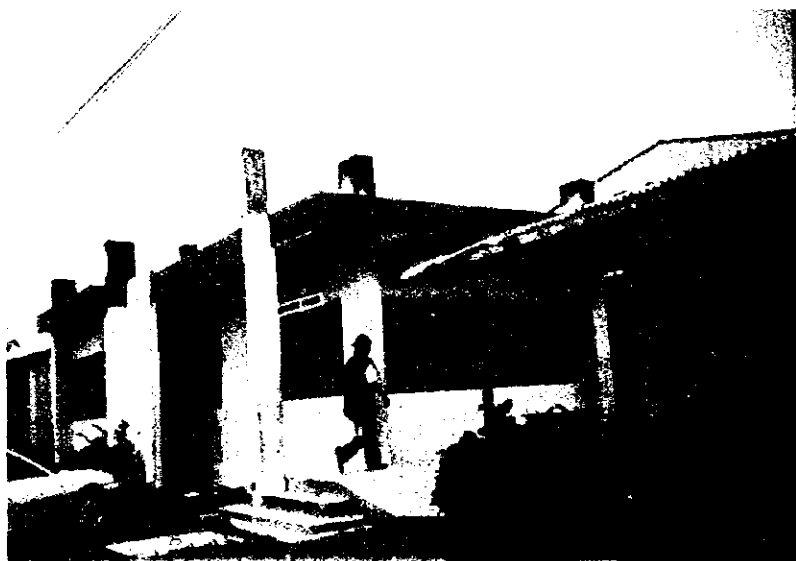
**USP Cook Islands Centre**



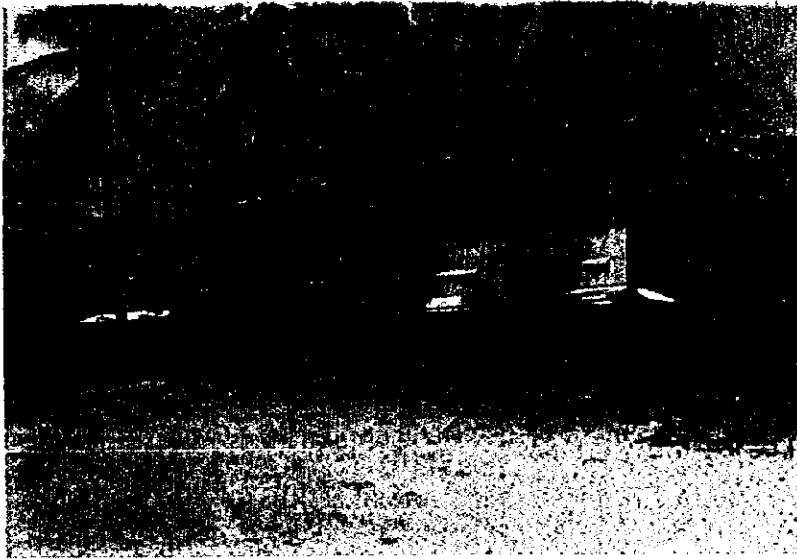
**USP Cook Islands Centre  
(Tutorial Room)**



**USP Kiribati Centre**



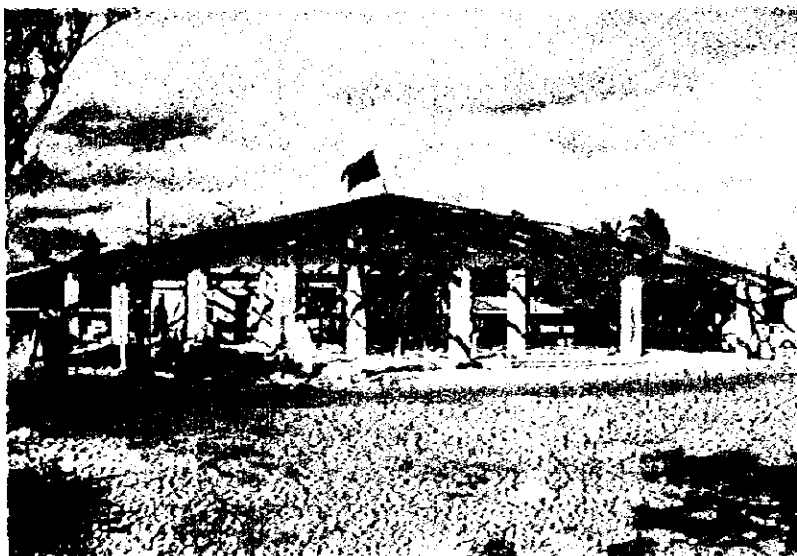
**USP Marshall Islands Centre**



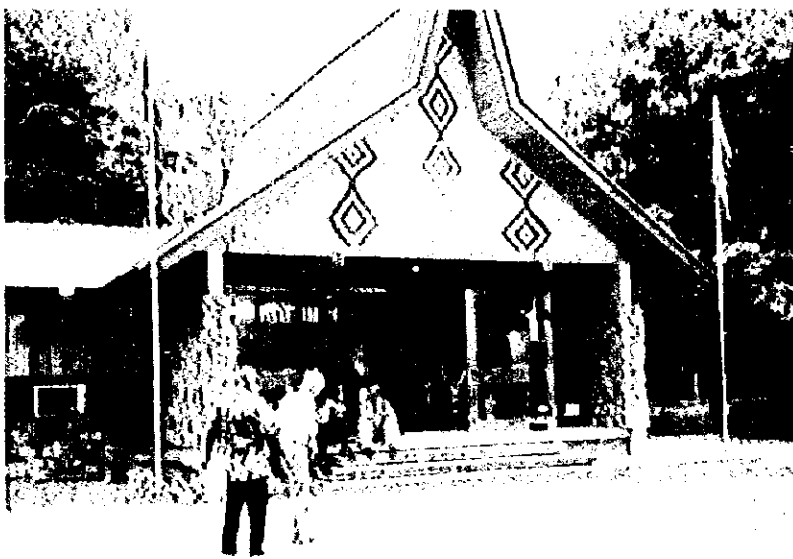
**USP Nauru Centre**



**Government Office, Niue**



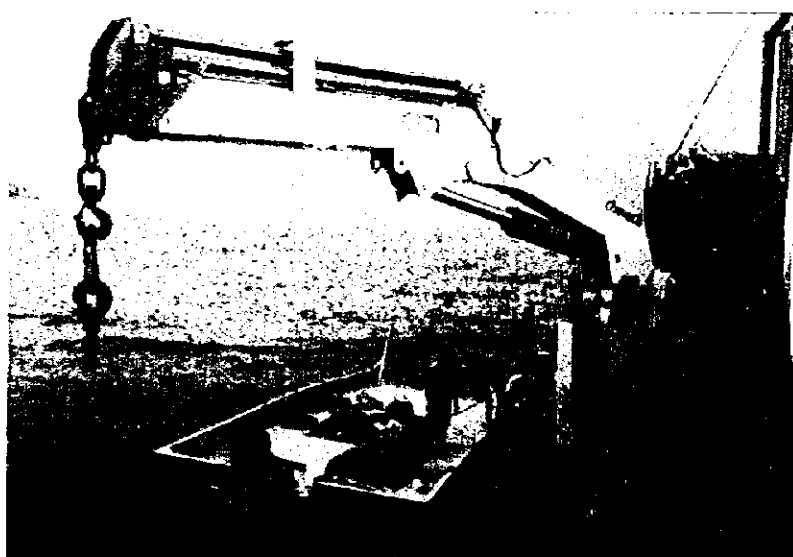
**USP Niue Centre  
(New Centre  
under construction)**



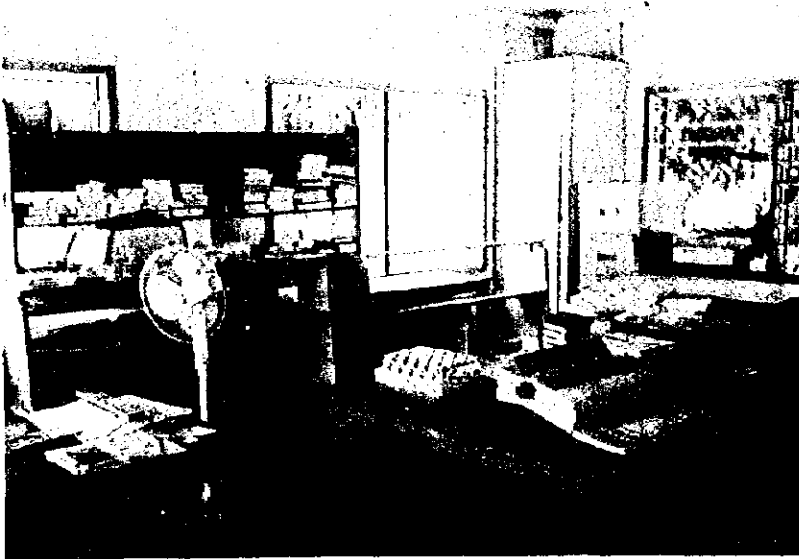
**USP Solomon Islands Centre**



**USP Solomon Islands Centre  
(Tutorial Room)**



**Barge of Atafu atoll, Tokelau**



**USP Tokelau Centre**

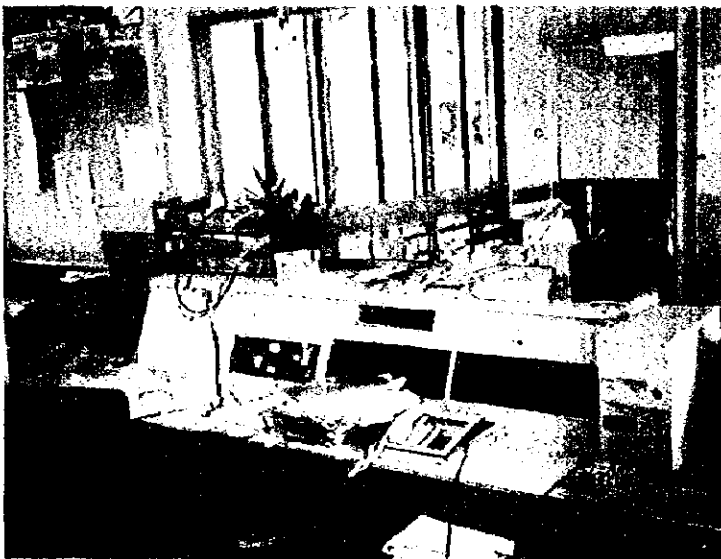
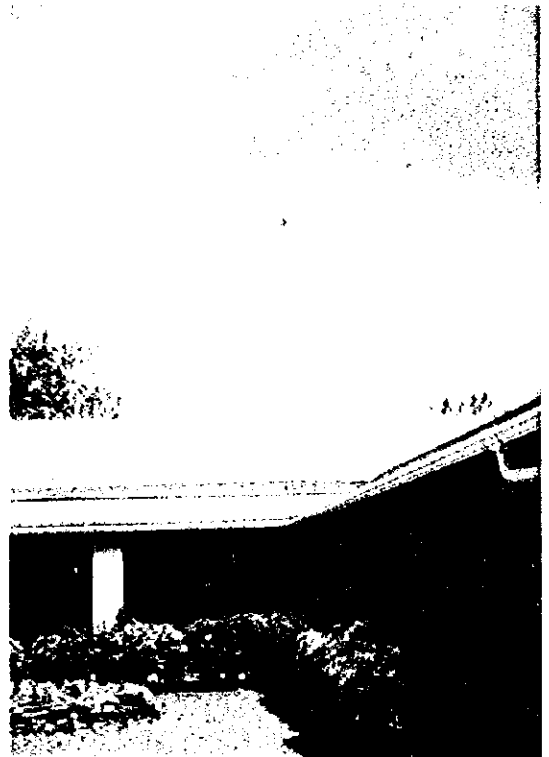


**USP Tonga Centre**

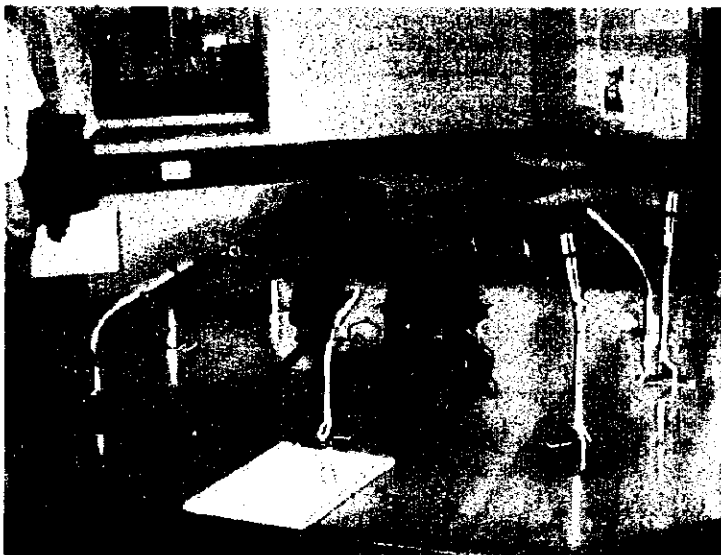


**USP Tuvalu Centre**

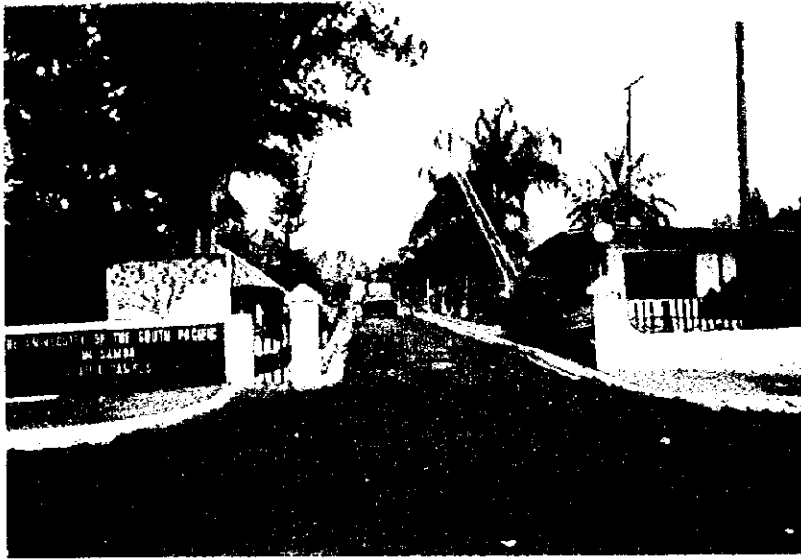
**USP Tubalu Centre**



**USP Vanuatu Campus  
(Tutorial Control Room)**



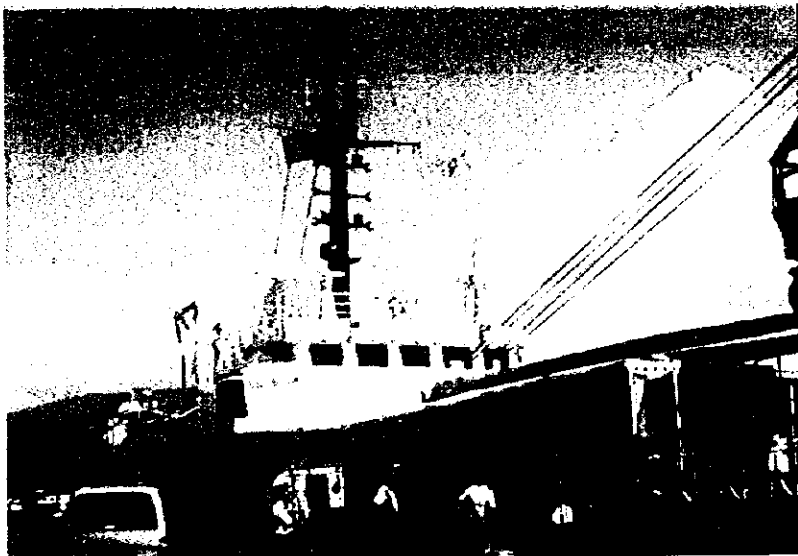
**USP Vanuatu Campus  
(Tutorial Room)**



**USP Samoa Campus**



**Tokelau Administration  
Office in Samoa**



**Ship for  
Samoa-Tokelau Service**





# **The Project for Upgrade of USPNet Communications System**

**In**

**The Republic of Fiji**

## **Contents**

Chapter 1	Background of the Project	.....	1
Chapter 2	Contents of the Project	.....	3
2-1	Objectives of the Project	.....	3
2-2	Basic Concept of the Project	.....	4
2-2-1	Policy of Cooperation	.....	4
2-2-2	Contents of Request	.....	4
2-3	Basic Design	.....	15
2-3-1	Design Concept	.....	15
2-3-2	Basic Design	.....	15

<b>Chapter 3</b>	<b>Implementation Plan (Fiji and Samoa)</b>	<b>.....</b>	<b>21</b>
<b>3-1</b>	<b>Implementation Plan</b>	<b>.....</b>	<b>21</b>
<b>3-1-1</b>	<b>Implementation Concept</b>	<b>.....</b>	<b>21</b>
<b>3-1-2</b>	<b>Implementation Conditions</b>	<b>.....</b>	<b>23</b>
<b>3-1-3</b>	<b>Scope of Works</b>	<b>.....</b>	<b>23</b>
<b>3-1-4</b>	<b>Consultant Supervision</b>	<b>.....</b>	<b>25</b>
<b>3-1-5</b>	<b>Procurement Plan</b>	<b>.....</b>	<b>27</b>
<b>3-1-6</b>	<b>Implementation Schedule</b>	<b>.....</b>	<b>29</b>
<b>3-1-7</b>	<b>Obligations of Recipient Country</b>		<b>30</b>
<b>3-2</b>	<b>Project Cost Estimation</b>	<b>.....</b>	<b>32</b>
<b>3-3</b>	<b>Operation and Maintenance Costs</b>	<b>.....</b>	<b>32</b>
<b>Chapter 4</b>	<b>Project Evaluation and Recommendation</b>	<b>...</b>	<b>34</b>
<b>4-1</b>	<b>Project Effect</b>	<b>.....</b>	<b>34</b>
<b>4-2</b>	<b>Recommendation</b>	<b>.....</b>	<b>34</b>

## **Appendices**

<b>Appendix 1</b>	<b>Member List of the survey Team</b>
<b>Appendix 2</b>	<b>Survey Schedule</b>
<b>Appendix 3</b>	<b>List of Parties Concerned</b>
<b>Appendix 4</b>	<b>Minutes of Discussion</b>
<b>Appendix 5</b>	<b>Cost Estimation Borne by the Recipient Country</b>
<b>Appendix 6</b>	<b>Outline specification of Project Equipment</b>

## **List of Tables**

<b>Table 2-1</b>	<b>Number of Undergraduate Courses in USP</b>
<b>Table 2-2</b>	<b>USP Distance Education Enrolments by Level of Programme</b>
<b>Table 2-3</b>	<b>USP Distance Education Students by Country</b>
<b>Table 2-4</b>	<b>Classification of Size for USP Centres</b>
<b>Table 2-5</b>	<b>Functionality of VSAT Earth Stations (on page 13)</b>
<b>Table 2-6</b>	<b>Comparison between Proposed Design and Alternative Plan</b>
<b>Table 2-7</b>	<b>Equipment list for USPNet (Hub Station)</b>
<b>Table 2-8</b>	<b>Equipment list for USPNet (Mini-Hub Stations)</b>
<b>Table 2-9</b>	<b>Equipment list for USPNet (Remote Stations)</b>
<b>Table 2-10</b>	<b>Procurement List of Measurement Set and Spare parts</b>
<b>Table 3-1</b>	<b>Staff sent to Fiji (on page 26)</b>
<b>Table 3-2</b>	<b>Staff sent to Samoa (on page 26)</b>
<b>Table 3-3</b>	<b>Implementation Schedule (Fiji)</b>
<b>Table 3-4</b>	<b>Implementation Schedule (Samoa)</b>
<b>Table 3-5</b>	<b>Operation and Maintenance Costs (on page 33)</b>

## **List of Figures**

<b>Figure 2-1</b>	<b>USPNet System Configuration</b>
<b>Figure 2-2</b>	<b>Configuration of Hub Station</b>
<b>Figure 2-3</b>	<b>Configuration of Mini-Hub and Remote Stations</b>
<b>Figure 2-4</b>	<b>Site layout for USP Headquarters in Fiji</b>
<b>Figure 2-5</b>	<b>Site layout for USP Cook Islands Centre</b>
<b>Figure 2-6</b>	<b>Site layout for USP Kiribati Centre</b>
<b>Figure 2-7</b>	<b>Site layout for USP Marshall Islands Centre</b>
<b>Figure 2-8</b>	<b>Site layout for USP Nauru Centre</b>
<b>Figure 2-9</b>	<b>Site layout for USP Niue Centre</b>
<b>Figure 2-10</b>	<b>Site layout for USP Solomon Islands Centre</b>
<b>Figure 2-11</b>	<b>Site layout for USP Tokelau Centre</b>
<b>Figure 2-12</b>	<b>Site layout for USP Tonga Centre</b>
<b>Figure 2-13</b>	<b>Site layout for USP Tuvalu Centre</b>
<b>Figure 2-14</b>	<b>Site layout for USP Vanuatu Centre</b>
<b>Figure 2-15</b>	<b>Site layout for USP Samoa Centre</b>

## Chapter 1 Background of the Project

The University of the South Pacific (USP) is an international university established by twelve countries and territories in the South Pacific. The number of students leaning at USP is 9,381 as of end 1996 and about 66% of them are Fijians. 5,434 students (approximately 58%) are taking distance education courses provided by USP. Where many of USP member countries and territories have difficulty to establish its own high level education facility, USP is playing very important role as the high level education facility for these island countries and territories in the South Pacific. Many graduates from USP are accepted in major leading posts of each country or territory.

USP Headquarters are located in Suva, Fiji, and providing high level education to the students from the member countries and territories. However, many students have difficulty to attend the courses at USP campus in Fiji due to costs required for travel to and stay for years in Fiji, and geographical distance from Fiji. USP has recognized the importance of distance education since its foundation in 1970, as distance education can offer the opportunity of high level education to the students living in their own countries and territories.

USP has established the USP Centres in each member country or territory as a focal point for distance education. USP Centre receives the texts, work books, audio tapes, video tapes for distance education from USP Headquarters and delivers these materials to the students at each centre. USP is providing audio tutorials for the students learning at USP Centres through USP's communications network (USPNet) consisting of its own short wave radio communications links and dedicated links leased from telecommunications entities. However, short wave radio links are not feasible for tutorials due to its poor quality and simplex operation, and leased links are only available at limited Centres at Vanuatu, Cook Islands, Solomon Islands, Tonga and Lautoka (Fiji). USP is having difficulty to provide effective and efficient distance education to its students at USP Centres.

Hence, USP has established the Project for Upgrade of USPNet Communications System for smooth provision of distance education to USP Centres in all member countries and territories. The Project intends to implement USP's own satellite communications network and in 1995 USP Chancellor, the President of Marshall Islands has forwarded the request for Grant Aid to the Government of Japan.

In 1997, Prime Ministers of Japan and New Zealand agreed to facilitate this project collaboratively. Later on, the Government of Australia showed the interest to join this collaborative project and it became the tripartite project funded by the Governments of Japan, New Zealand and Australia.

On this basis, the Government of Japan sent the Preliminary Study team organized by Japan International Cooperation Agency (JICA) in June 1997, and confirmed the background and the contents of request. According to the Preliminary Study result, the Government of Japan sent the Basic Design Study team also organized by JICA, from September 20<sup>th</sup> to October 23<sup>rd</sup>, 1997.

## Chapter 2 Contents of the Project

### 2- 1 Objectives of the Project

This project is to contribute the enhancement of distance education and improvement of efficiency in administrative operation of the University of the South Pacific, by improvement of its communications system called USPNet.

The University of the South Pacific (referred as USP hereafter) is the international university operated by 12 South Pacific countries and territories including Fiji where USP is headquartered. USP is playing very important role for personnel development in the South Pacific in providing university education to the students from South Pacific countries and territories.

USP has established an improvement plan for its communications system by constructing USP owned communications network (USPNet) between its Headquarters in Fiji and USP Centres in other member countries and territories, and by introducing associated terminal equipment at each site, so that USP can provide satellite tutorials to all USP Centres and improve the efficiency of administrative operation.

Considering this plan, the objectives of this project is set to construct the USPNet and to improve the communications system between USP Headquarters and USP Centres. Accordingly, the project contributes in the enhancement of distance education provided by USP, and ultimately contributes to spread the opportunities and to improve the quality of higher level education in the South Pacific countries and territories.

This project is to be carried out by cooperation of three donor countries, Japan, New Zealand and Australia, for upgrading overall communications network of USP.

## 2- 2 Basic Concept of the Project

### 2- 2 - 1 Policy of Cooperation

This project covers twelve USP member countries and territories and constructs USP owned satellite communications network using VSAT (Very Small Aperture Terminal) earth stations at USP Headquarters in Fiji and at USP Centres in eleven other member countries and territories (Cook Islands, Kiribati, Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu). This network will enable USP to provide satellite tutorials to all USP Centres. The design of the network will also provide video capability for the future provision of live lecture delivery and interactive video conference.

In order to cover all twelve countries and territories, this project is carried out not only by Japan, but with cooperation with New Zealand and Australia. Demarcation of the project is as given below.

Japan: Six countries (Fiji, Samoa, Marshall islands, Solomon Islands, Tonga and Tuvalu)

New Zealand: Four countries and territories (Cook Islands, Nauru, Niue and Tokelau)

Australia: Two countries (Kiribati and Vanuatu)

At the project implementation, sufficient coordination is required among Japan, New Zealand and Australia as well as among the Japanese projects under either General Grant Aid or Grassroots Assistance program.

### 2- 2 - 2 Contents of Request

#### ( 1 ) Study of Design Conditions

##### ① Position of Distance Education

Number of enrolment at USP in 1996 was 9,381 students including 5,434 students (58% of total number) learning in distance education courses, and approximately 66% of total are Fijian nationals. USP is



contributing to its member countries and territories in personnel development and many graduates from USP are working as high officials of each Government.

USP has its main campus at Laucala, Suva in Fiji, two smaller campuses allocated in Apia, Samoa and Port Villa, Vanuatu and most of lectures are provided there. The governments of the member countries and territories send selected students with national scholarship to the campus. However, the scholarship can not be given to all applicants and USP provides distance education courses to offer the opportunity for wider range of students to take up university education in their own countries and territories.

In the first term of 1997, USP accepted enrolments from 9,208 students in 336 courses and 5,194 students (56.4%) in 89 courses (26.5%) among them are in distance education courses.

USP Centre is placed in each country or territory as a base of distance education and the students receive their course materials such as text books, work books, audio and video tapes. The students can also receive and send back their assignments from/to teaching staff in the campus through USP Centre. USP also supports the students in distance education courses by following means.

- tutorial visits by campus lecturers
- tutorials by local tutors and/or
- satellite tutorials (tutorials through communications)

For wider spreading of distance education, the enhancement of tutorials is an important issue as the students can achieve much better results with prompt resolution of questions raised in their minds by proper and interactive assistance from tutors.

Satellite tutorials, using audio conferencing, are currently scheduled for around 25 hours per week and most of them are carried out from USP Headquarters in Fiji, but 7 to 8 hours of them are carried out from Emalus campus in Vanuatu. Satellite tutorial is

available for about two thirds of distance education courses and 329 tutorial sessions were conducted in 1996. However, satellite tutorial is currently available to only five USP Centres in Vanuatu, Cook Islands, Solomon Islands, Tonga and Lautoka in Fiji. Other USP Centres cannot appreciate the benefit of satellite tutorials, as the communications between the campuses and these USP Centres are either unstable or simply not available.

## ② Organization for Distance Education

The distance education of USP is operated by "University Extension" based at USP Laucala campus in Fiji. It is responsible for program development and management of distance education.

In addition to campuses in Fiji, Samoa and Vanuatu, each of USP member country and territory has USP Centre as a base of distance education. USP Centres usually have the facilities such as class rooms, library, computer laboratory and science laboratory. USP Centres carry out the distance education tasks such as registration of enrolments, distribution of course materials, handling of course works for students, employment of local tutors, scheduling of tutorials and end term examination. USP Centres in Fiji, Vanuatu and Samoa have sub-centres in each country and are providing the assistance to students learning there.

## ③ Status of Distance Education

Distance education of USP is offered in 15 week semester and 30 week semester, and for the courses of Preliminary, Foundation, Certificate and Degree. Degree and Foundation courses are popular with 48.8 % and 37.9 % of enrollments, respectively. Tables 2-1 and 2-2 show the number of distance education courses offered and the number of enrollments in various courses.

The biggest USP Centre except for Fiji is Solomon Islands Centre which has 488 students and the smallest is Niue Centre with 17 students, as of end 1996. Tables 2-3 and 2-4 show the number of enrollments at each centre and the status of each centre,

respectively.

The USP member countries and territories except Fiji, Samoa, Solomon Islands and Tonga have no higher education facilities beyond high schools, and the students in these countries and territories rely their university education on USP Centres as either part time or full time students at USP Centre.

In distance education, there is a problem of withdrawal during course due to loss of eagerness to study, change of environment or any other reason. According to 1996 University Extension Annual Report of USP , the attrition rate is 20.8% in average for all USP Centres, but it varies significantly among USP Centres. Nauru, Niue and Tuvalu centres have higher than average attrition rates of 53.2%, 39.3% and 35.9% respectively. Considering that the pass rate of course end examination is not significantly different among USP Centres, one explanation to the significant variation of attrition rate is lack of communication with course lecturer or tutor for students learning in these USP Centres. Another reason is insufficient literatures in libraries of some USP Centres. These barriers to study can be removed by improving the communications between USP Centres and USP Headquarters so that the tutorials become available at all USP Centres and students can get required materials for their study in timely manner.

Administration of distance education will also become more efficient by improved communications between USP Centres and USP Headquarters.

#### ④ Status of Satellite Tutorials

Today, the satellite tutorial (tutorial through voice communications) is only available at Vanuatu, Cook Islands, Solomon Islands, Tonga and Lautoka (Fiji) Centres. These USP Centres except for Cook Islands Centre are connected with USP Headquarters at Laucala, Fiji, by 64 kbps leased communication circuits, while Cook islands Centre is served by 19.2kbps circuit.

Other Centres are lacking suitable communications with USP Headquarters and cannot enjoy the benefit of satellite tutorials.

Satellite tutorials are currently provided for about 25 hours per week. Most of them are provided from USP Headquarters in Fiji and seven to eight hours per week of tutorials are provided from Emalus campus in Vanuatu. In 1996, the number of enrollments for distance education courses in Vanuatu, Solomon Islands, Cook Islands and Tonga Centres was 1,362, which is about a quarter of total enrollments of 5,434 or about 57% of enrollments excluding about 3,000 enrollments in Fiji. The number of tutorials carried out in 1996 was 329 for about two thirds of the distance education courses. This is about 60% of the planned tutorials. As the year 1996 was a transition period for USPNet, the number of tutorials carried out is low.

In 1997, the number of planned tutorials is 750 for a year according to weekly schedule. As the average participation in a tutorial session is 10 students, total participants would be 4,500 students in 1997, assuming the same carried out to planned ratio.

USP Centres in Kiribati, Nauru, Niue, Tuvalu and Samoa have short wave radio for communications with USP Headquarters, but it is not good enough for tutorials because of frequent degradation due to unstable propagation, noise and interference. Therefore, the tutorials are given up and the radio is used for administrative correspondence only.

Public switched telephone lines are connected to most of USP Centres. They are operated by communications companies via Intelsat satellite, but still suffering from obsolete land line between international switch and USP Centre in many places. Anyway, public switched telephone lines are too costly for provision of tutorials. After all, the students learning at USP centres without tutorial opportunity are vulnerable to reduce their eagerness to study.

## **(2) Conclusion on Review of Request**

### **① Contents of Request**

The Government of Fiji has requested to the Government of Japan to provide earth stations in Fiji for USPNet in conjunction with other USPNet earth stations in USP member countries and territories to be provided under other aid schemes offered by the Governments of Japan, New Zealand and Australia.

As a system, USPNet is requested to provide the two-way 64 kbps digital communications links between USP Headquarters in Fiji and twelve other USP Centres including Lautoka Centre in Fiji by establishing USP's own network.

Further to these 64 kbps links, the system should be provided with video transmission/reception capability at each earth station. The Hub earth station in Fiji should be capable of transmitting three simultaneous video channels for lectures or setting two simultaneous video conferences with other earth stations. Mini-Hub earth stations in Samoa and Vanuatu should be capable of transmitting one video lecture or setting one video conference with Hub earth station. Remote earth station in other USP member countries and territories should be capable of setting one video conference with Hub earth station.

### **② Conclusion on Review of Request**

#### **(Project Sites)**

VSAT earth stations are to be installed at USP Headquarters and USP Centres in eleven countries and territories for establishing USPNet satellite communications system as follows.

Hub earth station:	Fiji
Mini-Hub earth station:	Samoa and Vanuatu
Remote earth stations:	Cook Islands, Kiribati, Marshall Islands, Nauru, Niue, Solomon Islands, Tokelau, Tonga and Tuvalu

Installation of Remote earth station at Lautoka Centre in Fiji is considered not feasible and dropped out of the project for the following reasons.

- there is an existing two way 64 kbps link between Lautoka Centre and USP Headquarters,
- Lautoka Centre locates on the same islands as USP Headquarters and students of Lautoka Centre can visit or communicate with their tutor relatively easily, and
- as it is on the same island as USP Headquarters, future enhancement of optical fiber network by telecommunications company is foreseen and higher rate service will be available in the future. Therefore, the communications through land line is to be a preferred option to satellite link, for providing enhanced services including video to Lautoka Centre.

The timing for Remote earth station in Tokelau may require further discussion between the Government of Tokelau, USP and NZODA. However, Hub earth station is designed to have modulator/demodulator for Tokelau.

An interim proposal for Tokelau using leased capacity is also being considered for the short term.

(Links for Tutorials)

Satellite tutorials are currently provided through 64 kbps leased lines between USP Headquarters and USP Centres in Vanuatu, Solomon Islands, Tonga and Lautoka (Fiji). The communications terminal equipment for 64 kbps leased lines at these USP Centres are newly installed ones and suitable for reuse in this project. Therefore, the links for audio tutorials in this project is designed to have a compatible bit rate with current leased lines at 64 kbps.

In order to expand the tutorials to all USP member countries and territories, 64 kbps two way data links are to be established between Hub earth station in Fiji and Mini-Hub and Remote earth stations in

all other member countries and territories. This will assure the tutorial provision as scheduled. As a total, 11 two way links at 64 kbps are required for this purpose, between USP Headquarters and 11 USP Centres excluding Lautoka Centre in Fiji which has 64kbps terrestrial leased line to USP Headquarters.

These 64 kbps links will also improve the administration of distance education as they provide highly reliable communication measures for the staffs at USP Centres.

**(Links for Video Transmission)**

USP has a plan to transmit live lectures from its campuses in Fiji, Vanuatu and Samoa, and to provide tutorials by video conference from Fiji. In order to meet this requirement, modulators and demodulators for 128 kbps are included in the earth station equipment and transmitters are designed to have enough power for video transmission.

USP is requested to purchase video specific equipment for all USPNet earth stations for making best use of video transmission capability provided in this project. Video specific equipment includes codecs, cameras and monitors.

The number of video channels on the satellite is set to be a total of four for two pairs of two-way links for video conference, considering simultaneous set up of two video conferences between Hub and two of Mini-Hub or Remote earth stations. When video conference is not on, these channels can be used for transmission of up to four lectures simultaneously.

However, the video channel is to be also used for lecture transmission by Mini-Hub earth stations and for the return link for video conference in direction from Mini-Hub or Remote earth station to Hub earth station. Hence, Hub earth station has slim chance to transmit four video channels and barely require four sets of

modulator and demodulator. On the other hand, Laucala campus in Fiji is the main campus of USP and has many lectures, hence it is desirable that Hub earth station has the capability of having one video conference along with transmitting two lectures. Therefore, Hub earth station is designed to have three sets of 128 kbps modulator and demodulator. With this capability, Hub earth station can execute either of following combination of video channel operation.

- simultaneous transmission of up to three lectures,
- one video conference along with simultaneous transmission of up to two lectures,
- two simultaneous video conferences

Hub earth station receives lecture(s) from Mini-Hub earth station(s) and return video channel in direction from Mini-Hub or Remote earth station to Hub earth station during video conference.

USP provides approximately 250 courses at its campuses and most of them are at Laucala campus in Fiji. Each course usually has three lectures of one hour each and total lecture time per week becomes 750 hours.

Considering time difference among USP member countries and territories, and the international date line crossing the USP area, suitable time slot for live lectures is assumed as five hours on five days in a week. On this assumption, live lecture is provided up to 25 hours per week for single transmission link. Three transmission links requested by USP provides 75 hours which is 10% of total lectures at USP campuses. This is a reasonable number at preliminary introduction stage of new scheme for distance education.

USP also has campuses in Vanuatu and Samoa and Mini-Hub earth stations in these countries are designed to have capability of single video channel transmission for live lecture to be received by other earth stations including Remote earth stations along with three simultaneous lecture reception from Hub or other Mini-Hub earth station(s), or video conferencing with Hub earth station along



station(s). Therefore, three sets of modulator and demodulator for video channel are provided at Mini-Hub earth station.

Remote earth stations are designed to have two sets of modulator and demodulator for video channel for setting up one video conference with Hub earth station along with reception of one lecture, or simultaneous reception of two lectures from Hub and/or Mini-Hub earth station(s). These two sets also have a role as spare unit for 64kbps modulator and demodulator unit for data link, as all modulator/demodulator units can be reconfigured as 64 kbps unit by remote commands from Hub Earth Station in Fiji.

(Project dimension)

As a result of careful review of USP request, this project is designed to install VSAT earth stations with following functionality for establishing the satellite communication network for USP to provide voice tutorials, voice/fax/data communications through 64 kbps links between USP Headquarters and USP Centres and to provide 128 kbps video transmission capability for planned live lecture delivery and video tutorials.

[VSAT Earth Station Equipment]

Table 2-5 Functionality of VSAT Earth Stations

Country or Territory	Category of Earth Station	Functionality
Fiji	Hub	Communications: 64 kbps two-way x11 128 kbps two-way x 3 Control and monitor of Mini-Hub and Remote earth stations
Samoa, Vanuatu	Mini-Hub	Communications: 64 kbps two-way x1 128 kbps two-way x 1 128 kbps receive x 2
Cook Islands, Kiribati, Marshall Islands, Nauru, Niue, Solomon Islands, Tonga, Tuvalu, Tokelau	Remote	Communications: 64 kbps two-way x1 128 kbps two-way x 1 128 kbps receive x 1

Hub earth station antenna at USP Headquarters in Fiji will be a 7.6m dish and Mini-Hub and Remote earth station antennas will be 4.5 m dishes.

**[Audio Tutorial Equipment]**

Each USP Centre will be installed with equipment such as microphone and speaker for audio tutorial. Where USP Centre has existing tutorial equipment, it is to be reused and new equipment will not be installed.

**③ Comparison with Alternative Plan**

The alternative to USP's own satellite communications network is a network composed of leased lines from telecommunications companies in the region. Table 2-6 presents comparison between this project plan and the alternative plan.

The alternative plan requires less initial cost but more running cost, relies implementation schedule on telecommunications companies and provides less operational flexibility in comparison to this project plan. Potential problem in this project plan was availability of radio station licenses in each country, but it was mostly cleared with explanation of USPNet by Basic Design Study team during study visits. Only Telecom Cook Islands remain opposed to the granting of a license for the Cook Islands USPNet earth station, though the Tokelau operator, Teletok, indicated that further consideration of the needs of USP would be required.

Putting importance on more operational flexibility, firmer implementation schedule and less running cost, this project plan is adopted.

## 2-3 Basic Design

### 2-3-1 Design Concept

In establishing Basic Design, natural and social conditions of the USP member countries and territories, issues in installation works and procurement are considered. Furthermore, the uniqueness of this project, to involve twelve recipient countries and territories and three donor countries, is also taken into consideration. Based on these considerations, the following design concept is adopted.

- ① Between the Hub earth station in Fiji and other earth stations in this project, equipment compatibility for mutual communication should be maintained and installation schedule of each station should be well coordinated.
- ② Outdoor installations should have enough strength to endure in strong winds caused by Cyclones and all installation methods should be earth quake proof.
- ③ Painting of equipment should endure in high temperature and humidity as well as salt damage.
- ④ Safety of university staffs and students should not be violated during installation works and in operation.
- ⑤ Interfacing with existing USPNet equipment should be made available as much as possible.
- ⑥ As the project is implemented under the assistance program, the implementation schedule should be strictly maintained with due consideration in transportation plan, installation method and verification test procedures.
- ⑦ At installation works, relevant USP staff should be invited to participate actively and to familiarize themselves with the equipment for the operation and maintenance.

### 2-3-2 Basic Design

#### (System Configuration)

This project is to establish a dedicated satellite communications network for USP for improvement of its communications system. The network is composed of twelve VSAT earth stations. Figure 2-1 shows the system configuration. Hub earth station is installed at USP Headquarters in Fiji, Mini-Hub earth stations in Vanuatu and

Samoa, and nine Remote earth stations at USP Centres of Cook Islands, Kiribati, Marshall Islands, Nauru, Niue, Solomon Islands, Tokelau, Tonga and Tuvalu.

(Satellite)

USP Centres are scattered in very wide area of the South Pacific for 4,000 km from its eastern end at Cook Islands (160 W longitude) to western end at Solomon Islands (159 E longitude) and 3,000 km from its northern end at Marshall Islands (7 N latitude) to southern end at Tonga (21 S latitude). The only commercial communications satellite covering this very wide area is Intelsat with its Global beam in C-band frequency (6 GHz for Earth to Satellite direction and 4 GHz for Satellite to Earth direction). USP will lease the required satellite capacity of 3.1 MHz of the global beam transponder of Intelsat.

(Earth Stations)

Hub earth station in Fiji is designed to have the capability of transmit and receive eleven 64 kbps channels and three 128 kbps channels. The simultaneous transmission of these channels requires Intelsat Standard F2 class earth station with 7.6 m dish for its antenna and 100 watt power amplifier. The size of antenna and power amplifier were traded off and this combination is found in good balance, as 7.6 m dish is common for Intelsat F2 earth stations and 100 watt amplifier is available with solid state devices which require less maintenance than vacuum tubes.

Hub earth station is also equipped with monitor and control capability for Mini-Hub and Remote earth stations. With this capability, Hub earth station can control transmit and receive frequencies of modulator/demodulator and transmit power at other earth stations and can monitor the equipment status at other earth stations as well. Thus, Mini-Hub and Remote earth stations are not required to have technical operator. Even in case of equipment failure, a maintenance staff at Hub earth station can identify defective equipment and can go out to fix it with proper spare parts.

The Mini-Hub earth stations are designed to have the capability of transmitting a single 64 kbps channel and single 128 kbps channels, and receiving a single 64 kbps channel and three 128 kbps channels. This requires an Intelsat F1 class earth station with 4.5 meter dish antenna and a 50 watt power amplifier so that the 128 kbps transmission can be received at the Remote earth stations.

The nine Remote earth stations are designed to have the capability of transmitting a single 64 kbps channel and a single 128 kbps channel, and receiving a single 64 kbps channel and two 128 kbps channels. This requires an Intelsat F1 class earth station with 4.5 meter dish antenna and a 20 watt power amplifier since the 128 kbps transmission is only to be received at the Hub earth station.

#### (Equipment Lists)

Tables 2-7 through 2-9 show the equipment lists of various types of earth stations implemented in this project. Figures 2-2 and 2-3 show the equipment configuration of Hub earth station and Mini-Hub/Remote earth station.

#### (Site Plans)

Antenna for each earth station should be installed at a site where visibility of Intelsat satellite is secured and the ground provides firm support to the antenna foundation. Equipment room to accommodate indoor equipment should be in the vicinity of antenna site and have enough floor strength to support indoor equipment.

The area required for antenna installation is about 100 square meter for Hub earth station and about 36 square meter for Mini-Hub and Remote earth stations. The space required for indoor equipment installation is about 24 square meter for Hub and about 6 square meter for Mini-Hub and Remote earth stations.

Site plan for each project site is given below;

**(1) Fiji**

Figure 2-4 shows the site layout.

Site 1 through 4 were considered for antenna site and Site 4 was chosen for the reason of good supporting ground. USP will expand the building adjacent to antenna site for provision of the equipment room.

**(2) Cook Islands**

Figure 2-5 shows the site layout.

Site 1 through 3 behind USP Centre building were considered for antenna site. Every site is technically feasible and the choice was Site 3 according to USP intention. Equipment room is at a corner of existing building and it is about 30 m to the antenna site and about 60 meter to the existing tutorial room.

**(3) Kiribati**

Figure 2-6 shows the site layout.

Southern side of the library building is reserved for expansion. Site 1 and 2 are considered for antenna site. Both sites are technically feasible and the choice was Site 2 following USP intention. Equipment room is found at vacant storage room next to lecture room.

**(4) Marshall Islands**

Figure 2-7 shows the site layout.

USP Centre is located within premises of the College of Marshall Islands (CMI). There is not enough room to accommodate an antenna within USP Centre and the site had to be in CMI premises, but no objection was made against this choice. Indoor equipment will be installed along the wall as the room is limited in the centre.

**(5) Nauru**

Figure 2-8 shows the site layout.

Three sites at South, West and North of USP Centre building were considered and North side of the building was chosen as the best one on the basis of skyline and surrounding environments.

Equipment room is to be existing Class room 3 because of layout convenience of antenna site and lecture room. Class room 3 will be relocated to a room next to computer room.

**(6) Niue**

Figure 2-9 shows the site layout.

New building for USP Niue Centre was under construction and a corner close to planned equipment room was chosen as antenna site. Equipment room is assigned a part of lecturer's room which is about 5 meter from the antenna site.

**(7) Solomon Islands**

Figure 2-10 shows the site layout.

The land is limited at this centre, but antenna site was found at rear yard of Science Laboratory building. A side of the site is a steep slope and a protection wall is to be constructed by USP to prevent falling rock and sand. Existing tutorial room is planned to be relocated to a larger room in planned expansion building and equipment room is to be in the same building as new tutorial room. The expansion building is just 6 to 7 meters from the antenna site.

**(8) Tokelau**

Figure 2-11 shows the site layout.

Two sites, one near the workshop and the other near the water tank were considered. For the installation of the antenna, both sites require negotiation with land owner and agreements from National Fono (assembly). The site near the workshop is chosen because of closer location to class room. Equipment room is to be a part of workshop next to class room.

**(9) Tonga**

Figure 2-12 shows the site layout.

Antenna site is chosen at rear side of the administration building and close to existing tutorial control room. Equipment can be accommodated in existing tutorial control room.

(1 0) Tuvalu

Figure 2-13 shows the site layout.

The antenna site identified in Basic Design Study visit was rejected later by USP, and USP further identified two sites for consideration. From these two candidate sites, antenna site is chosen in the premises of Red Cross hospital to the centre where more room is available than the candidate within the centre. There is no objection to put an antenna there. Equipment room is to be a storage room next to lecture room.

(1 1) Vanuatu

Figure 2-14 shows the site layout.

Antenna site is chosen at the yard beside library. Equipment room is to be provided by USP by expanding existing tutorial room in the vicinity of the chosen site.

(1 2) Samoa

Figure 2-15 shows the site layout.

The centre is planned to be relocated to Alafua campus and the antenna site is chosen next to Peacesat antenna site. Existing equipment room in administration building is within few meter of antenna site.



## **Chapter 3 Implementation Plan (Fiji and Samoa)**

### **3- 1 Implementation Plan**

#### **3- 1 - 1 Implementation Concept**

At the implementation of this project in Fiji and Samoa, following basic issues should be taken into consideration.

##### **(1) Responsible Organization**

Responsible organization of this project is Ministry of Communication, Works and Energy of Fiji for the project in Fiji and Treasury Department of Samoa for the project in Samoa. They are to be responsible for the consultant contract and procurement contract.

The counterpart in project implementation is to be the University of the South Pacific (Planning and Development Office). USP will take procedures for obtaining permissions and approvals required for implementation of the project. USP will also review, approve and instruct the contents of the project as appropriate in implementing the project.

USP is recommended to nominate a project manager who will be responsible for the above processes and will interface with the Consultant and Supplier.

##### **(2) Consultant**

The projects in Fiji and Samoa are implemented under General Grant Aid of Japanese government and, on Exchange of Notes with the Japanese government, the governments of Fiji and Samoa are to have contracts with the Japanese consultant recommended by Japan International Cooperation Agency. The consultant will prepare the tender documents, manage the bidding process and supervise the implementation. The consultant will send satellite communications engineers to the project site for supervising implementation works for the period of major installation works and on-site tests.

### **(3) Prime contractor**

The prime contractor will be chosen through open tendering for Japanese companies by the government of Fiji and Samoa with assistance provided by the consultant. Following the approval process in each government, the government of Fiji and Samoa will award the supply contract to the chosen company.

The prime contractor will carry out procurement of the project equipment and, installation, on-site adjustment and tests of the equipment.

### **(4) Implementation Plan**

Implementation works will start with delivery of the equipment to the project site followed by installation works of the equipment and on-site adjustment and tests of the equipment. The following points were taken into consideration in establishing the implementation plan.

- ① Both skilled and unskilled work forces can be sufficiently procured at the project sites.
- ② Annual rainfall at the project sites is about 2,800 mm and the summer period (November to April) is subject to Cyclones. The schedule of works depending its proceedings on the weather should consider the risk of delay. This applies to the works such as construction of antenna foundation and installation of outdoor cables.
- ③ The project site is within the area of academic and educational activities, and the harms such as noise and dusts should be kept minimum as far as possible.
- ④ The Japanese Grant Aid to the Governments of Fiji and Samoa will be used to implement the earth stations for educational satellite communications network at USP Headquarters in Fiji and USP campus in Samoa. Parallel to these earth stations, more earth stations will be implemented at ten other USP centres. These include four earth station under Japanese Grassroots Assistance (Marshall Islands, Solomon Islands, Tonga and Tuvalu), four earth stations

under New Zealand Aid (NZODA) (Cook Islands, Nauru, Niue and Tokelau) and two earth stations under Australian Aid (AUSAID) (Kiribati and Vanuatu). The overall coordination of implementation schedules should be borne in mind.

The projects in Fiji and Samoa are implemented under the Japanese Grant Aid program. Hence, the period of implementation works should be strictly maintained and the quality of works should also be maintained at high standard. Therefore, the engineering experts in antenna installation, radio equipment installation and radio equipment adjustment and testing should be sent from the manufacturer.

### 3-1-2 Implementation Conditions

The project sites are in the suburbs of the capital in each country and the procurement of work forces is comparatively easy. The establishment of supervisory formation for implementation works is still essential to maintain the implementation schedule, quality of works, work methods.

### 3-1-3 Scope of Works

#### (1) Implementation works undertaken by the government of Japan

In case this project is carried out under Japanese Grant Aid program, the government of Japan will undertake the following works.

##### ① Procurement and installation of the equipment

The equipment required for this project is to be procured. Hub earth station and Mini-Hub earth station are installed in Fiji and Samoa respectively. The lists of equipment for each station are given in Tables 2-7 and 2-8. The procurement list of measurement set and spare parts is given in Table 2-10.

Video specific equipment such as video codec, camera and monitor is not included.

② On-site adjustment and tests

Upon installation of each earth station, the equipment is to be adjusted to the Intelsat specification and on-site tests are to be carried out to confirm the performance and demonstrate it to Intelsat.

For verification of overall communication and control/monitor function, end to end test is to be also carried out between Hub earth station in Fiji and Mini-Hub and Remote earth stations in other USP member countries and territories.

③ Consultant Services

The consultant will assist the recipient government in detailed design of the project, tendering for procurement and supervision of implementation works.

④ Soft Component

An engineer will stay on at Hub earth station in Fiji for about three months, after completion of installation works and provide the assistance to USPNet operation and maintenance staff for early days of operation. This supportive effort can facilitate smooth start up of USPNet.

(2) Implementation works undertaken by Fiji side or Samoa side

In case this project is carried out under Japanese Grant Aid program, Fiji side or Samoa side will be requested to undertake the following works.

- ① Secure and prepare the land for antenna installation and installation of fences around the antenna following completion of antenna installation
- ② Preparation of air conditioned communications equipment room or space for installation of equipment
- ③ Procurement of video specific equipment such as video codec, camera and monitor for video communications
- ④ Acquisition of all required permissions and approvals for installation works and any other permissions and approvals

required for the project implementation

- ⑤ Cabling of primary electric power supply to the project site and undertaking of any required procedures and cost for that
- ⑥ Exemption of custom duties and taxes and coordination for prompt custom clearance regarding all the project equipment imported to the recipient country
- ⑦ Exemption of taxes and charges applicable to Japanese nationals providing the services for this project
- ⑧ Any other works required for the project implementation, excluding those undertaken by the government of Japan

#### 3-1-4 Consultant Supervision

On conclusion of the contract between the government of Fiji or Samoa and the prime contractor, the consultant will review and approve the equipment specifications and installation drawings, witness the factory test of the equipment, and liaise for coordination with relevant organizations in Fiji and Samoa, Embassy of Japan in Fiji and New Zealand, JICA offices in Fiji and Samoa, and USP. The consultant will also watch the proceedings of installation works for the projects under New Zealand or Australian aid program. For the on-site supervision, the consultant will send their satellite communications engineers as required to the project sites in Fiji and Samoa in order to supervise and instruct the installation works, witness the on-site tests.

The prime contractor will be requested to send a total of seven engineers to Fiji site, including a site manager, two engineers for 7.6 m antenna installation and four engineers for radio equipment and circuit control and management equipment installation. To Samoa, four engineers will be requested.

Tables 3-1 and 3-2 show the number of staff sent to Fiji and Samoa.

**Table 3-1 Staff sent to Fiji**

Source	Category	Number	Task
Consultant	Supervisor	3	Supervision of installation works (shared with Samoa)
Prime contractor	General Coordinator	1	Total coordination of installation works in Fiji and coordination with other project sites
	Antenna Engineer	2	Supervision of antenna installation works and on-site adjustment and tests of antenna
	Radio Equipment Engineer	4	Supervision of installation of radio equipment and circuit control and management equipment, and on-site adjustment and tests of these equipment

**Table 3-2 Staff sent to Samoa**

Source	Category	Number	Task
Consultant	Supervisor	3	Supervision of installation works (shared with Fiji)
Prime contractor	Antenna Engineer	2	Supervision of antenna installation works and on-site adjustment and tests of antenna
	Radio Equipment Engineer	2	Supervision of installation of radio equipment and on-site adjustment and tests of these equipment

The consultant will send three engineers for supervising the installation works in Fiji and Samoa as well as for coordination of the works at other USP centres.

### 3-1-5 Procurement Plan

The major equipment procured for this project is the earth station equipment composed of antenna and radio equipment. The equipment must meet the ITU Radio Regulations and Intelsat specifications when it is integrated as an earth station.

The earth station equipment should be manufactured and installed according to precise design, both mechanically and electrically. Hence, The manufacturer should have superior track record in performance and reliability of the equipment. The origin of equipment will not cause much difference in achieving required communications performance, as far as it is procured from the manufacturer with superior track record.

Considering the importance of Hub earth station in the planned satellite communications network, following points should be carefully considered in planning procurement of Hub earth station equipment.

- ① Hub earth station is the core of satellite communications network established in this project and its failure will affect the functionality of whole network. Thus, Hub earth station failure will reduce the network availability directly and the probability of Hub earth station failure should be kept very minimum. From this point of view, the earth station equipment supply record and operation track record in and around USP member countries and territories should be considered in procurement process. Sufficient liaison/coordination arrangement in equipment production period and thorough factory tests of products are to be requested to the manufacturer for achieving maximum availability in operational phase.
- ② All Mini-Hub and Remote earth stations should carry out the circuit line-up test with Hub earth station prior to actual operation of communications circuits. If the implementation schedule of Hub earth station slips, the overall project schedule would slip. Hence, the schedule of Hub earth station should be

strictly maintained. In order to achieve this, close and frequent coordination of implementation schedule is required between consultant and prime contractor.

- ③ In maintaining equipment in operational phase, the manufacturer is required to keep the supply of spare parts for sufficiently long period and to supply spare parts promptly. On this point, the prime contractor should be requested to submit a well thought out maintenance support plan.

With regard to the equipment for Mini-Hub and remote earth stations, it is strongly recommended to procure from the same manufacture as Hub earth station equipment for the following reasons.

- ① Mini-Hub and Remote earth stations are required not only to communicate with Hub earth station, but also to accept the equipment control by Hub earth station and to provide the equipment status to Hub earth station. As this control and monitor protocol is proprietary to each manufacturer, modulators/demodulators must be procured from the same manufacturer as Hub earth station equipment.
- ② In relatively short implementation schedule, a total of eleven Mini-Hub and Remote earth stations are to be implemented and actual installation works and on-site adjustment and tests should be carried out efficiently. If all the equipment comes from a single manufacturer, mechanical and electrical compatibility between parts of equipment is readily provided and contributes to maintain the implementation schedule.
- ③ Standardized maintenance procedure makes the job of maintenance staff easy and smaller number of different equipment is the better in this context. Furthermore, spare parts in stock becomes less, as the number of different equipment becomes smaller.



Among the earth station components, concrete foundation for antenna requires heavy materials. Therefore, the materials except for anchor bolts is to be procured locally and the foundation is constructed at the project site according to the design provided by antenna manufacturer. Anchor bolts for fixing the antenna to the foundation are to be provided by antenna manufacturer for maintaining the compatibility with antenna structure.

Measuring equipment and spare parts for Hub and Remote earth stations required for operation and maintenance are to be procured as a part of Hub earth station equipment and delivered to the maintenance base at Hub earth station. Spare parts for Mini-Hub earth station are to be procured as a part of Mini-Hub earth station equipment. Measuring equipment includes one set of equipment for Hub earth station and one more set for use at Mini-Hub or Remote earth station as required. Assuming single source procurement for earth stations under Japanese Grant Aid, spare parts include one set of spare parts for each of Hub and Mini-Hub earth station, one set of common spare parts for Remote earth stations. Table 2-10 shows the list of measuring equipment and spare parts.

### 3- 1 - 6 Implementation Schedule

Implementation schedule should be strictly maintained for the Grant Aid project and it should be precisely planned with due consideration to equipment and labor procurement, equipment transportation and natural environment.

Implementation schedule is optimized with careful considerations on the equipment procurement, installation works, on-site adjustment and testing. Major equipment is assumed to be procured from a manufacturer(s) with a superior track record and installed, adjusted and tested under supervision of the prime contractor.

Major works in the schedule are as follows.

- ① Manufacturing and transportation of equipment
- ② Building of antenna foundation and antenna installation
- ③ Installation of radio equipment
- ④ Adjustment and testing of equipment

Required period for implementation is 18 months for detailed design including tendering process and implementation. In parallel to the projects in Fiji and Samoa under Japanese Grant Aid program, ten other projects will be running to install Mini-Hub or Remote earth station. These are four projects under Japanese Grassroots Assistance (Marshall Islands, Solomon Islands, Tonga and Tuvalu), four projects under New Zealand's assistance program (Cook Islands, Nauru, Niue and Tokelau) and two projects under Australian assistance program (Kiribati and Vanuatu). For the successful and timely implementation of USPNet, all the project should be coordinated each other for harmonized implementation. Tables 2-3 and 2-4 show the implementation schedules for Fiji and Samoa respectively.

### 3- 1 - 7 Obligations of recipient country

Following necessary measures should be taken by the Fiji or Samoa Side on condition that the Grant Aid Programme for General Projects by the Government of Japan is extended to the Project.

- (1) USP should secure the land of the antenna site for the Project. The required site space is approximately 10m by 10m square for Fiji and 7m by 7m square for Samoa with appropriate wave guide or cable route to the equipment room by March 1999.
- (2) USP should undertake incidental outdoor structures such as fence, gate and exterior lighting in and around the Project site on completion of on-site installation works.
- (3) USP should provide the air-conditioned equipment room in the vicinity of antenna site to accommodate indoor equipment for the Project. Equipment room should have approximately 4m by 6m space for Fiji and 2m by 3m space for Samoa by June 1999.
- (4) USP should provide the electric power supply at the equipment room. Electric power capacity required is approximately 8.5 kVA

- for communications equipment and 4 kVA for air conditioner in Fiji. In Samoa, it is approximately 1 kVA and 1.5 kVA respectively.
- (5) USP should install the cables between the USP terminal equipment such as telephone, facsimile, PC or PBX and the Project equipment, and interconnect existing USP communications facility and the Project equipment.
  - (6) USP should procure video specific equipment such as video codec, cameras and monitors for all USPNet sites for effective use of video capability provided by the Project.
  - (7) USP should install all audio, data and video cabling external to the equipment room.
  - (8) USP should improve the lecture rooms for either audio or video conferencing as required.
  - (9) USP should take necessary measures for radio coordination procedures depicted in ITU Radio Regulations, for an application for use of INTELSAT space segment and for frequency registration for ITU Radio Bureau.
  - (10) Fiji or Samoa side should bear commissions to the Japanese foreign exchange bank for its banking services based upon the Banking Arrangement, namely the advising commission of the "Authorization to Pay" and payment commission.
  - (11) USP in coordination with the Government of Fiji or Samoa should ensure prompt unloading, tax exemption, customs clearance at the port of disembarkation and prompt internal transportation therein of the materials and equipment for the Project purchased under the Grant Aid.
  - (12) The Government of Fiji or Samoa should exempt Japanese juridical and physical nationals engaged in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in Fiji or Samoa with respect to the supply of the products and services under the verified contracts.
  - (13) The Government of Fiji or Samoa should accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into Fiji or Samoa and stay therein for the performance of their work in accordance with the relevant laws and regulations of Fiji or Samoa.
  - (14) The Government of Fiji or Samoa should grant necessary permissions, licenses and other authorizations for implementing the Project, if necessary.

### 3-2 Project Cost Estimation

According to the scope of works (3-1-3), the initial costs to be undertaken by Fiji side and Samoa side is estimated as follows.

#### (1) Undertakings of Fiji side

Building expansion for equipment room	F\$36,000-
Air conditioner for equipment room	F\$15,000-
Cables installation	F\$5,000-
Total	F\$56,000-

#### (2) Undertakings of Samoa side

Air conditioner for equipment room	F\$15,000-
Cables installation	F\$5,000-
Total	F\$20,000-

### 3-3 Operation and Maintenance Costs

The USPNet established by overall project is composed of Hub earth station in Fiji and 11 Mini-Hub and Remote earth stations in other USP member countries or territories. However, the recurrent costs for operation and maintenance of USPNet will be borne by USP Headquarters in Fiji. Hence, operation and maintenance costs discussed here covers whole USPNet.

Major items of operation and maintenance costs include satellite transponder lease fee payable to Intelsat, AC power charge for earth station equipment and air conditioner, personnel cost of maintenance staff, travel expense for maintenance staff. Table 3-5 shows the estimated operation and maintenance costs for the first year and second to fifth year of operation.

Table 3-5 Operation and Maintenance Costs

Unit: US\$ 1,000

Item	Year 1	Year 2 through 5
Satellite Transponder Lease	251.0	251.0
AC Power for Earth Station Equipment	75.3	75.3
AC Power for Air Conditioner	28.5	28.5
Module Repair	0	63.7
Radio Licences	6.1	6.1
Maintenance Staff	142.0	142.0
Travel Expenses for Maintenance staff	22.0	22.0
Contingency for Year 1	26.2	0
Total	551.1	588.6

Earth station equipment at USP centres can be controlled and monitored by Hub earth station in Fiji so that each USP centre does not require technical operator. In case of equipment failure, maintenance staff at Hub earth station can usually know of the defective equipment from the monitoring information and can visit the failed station with proper spare parts and measuring equipment. Failure recovery would be done by replacing defective part with a spare. Failed part will be returned to the manufacturer for repair.

On top of visit upon failure, annual maintenance visit to each station is scheduled.

## Chapter 4 Project Evaluation and Recommendation

### 4-1 Project Effect

Currently working communications network from USP consists of five leased line links between USP Headquarters and other USP Centres. Vanuatu, Solomon Islands, Tonga and Lautoka (Fiji) Centres are served by 64kbps links and Cook Islands Centre by 19.2kbps link. These USP Centres can have tutorials by audio conferencing and administrative data transfer with USP Headquarters, but other USP Centres cannot enjoy this level of communication service with USP Headquarters. Expansion of leased lines to all other USP Centres will incur heavy operational cost to USP and will not be feasible. Lack of reliable communications measures cause significant obstacles to USP Centres for effective distance education and effective administration.

Once this Project for Upgrade of USPNet Communications System is implemented, all USP Centres will be able to enjoy tutorials and administrative data transfer through reliable dedicated USPNet. Accordingly each USP Centre will be able to provide more efficient support to the students learning in distance education courses and to improve day to day administrative operation of the Centre. It will certainly contribute USP to achieve its obligations much better than today.

### 4-2 Recommendation

USP is recommended to undertake following tasks for successful implementation and sustainable operation of USPNet.

- (1) USP should recruit and maintain required staff to operate and maintain the equipment provided in the Project.
- (2) USP should secure the budget for recurrent costs including lease cost of satellite capacity.
- (3) USP should establish appropriate teaching methods and programs for distance education through telecommunications media including video transmission.
- (4) Fiji or Samoa side should undertake the obligations of recipient country (Section 3-1-7 refers).

Table2-1 Numer of Undergraduate Courses in USP

External					Internal					All				
1992	1993	1994	1995	1996	1992	1993	1994	1995	1996	1992	1993	1994	1995	1996

## 1. Agriculture

Agriculture	0	0	4	8	9	64	56	52	54	62	64	56	56	62	71
Total	0	0	4	8	9	64	56	52	54	62	64	56	56	62	71

## 2. Humanities

Education & Psychology	26	27	29	27	33	19	17	24	24	30	45	44	53	51	63
Literature & Language	12	8	15	17	22	24	34	33	42	46	36	42	48	59	68
Unallocated	13	9	7	8	6	0	0	0	0	3	13	9	7	8	9
Total	51	44	51	52	61	43	51	57	66	79	94	95	108	118	140

## 3. Pure and Applied Sciences

Biology	2	4	2	4	4	14	13	14	13	14	16	17	16	17	18
Chemistry	5	6	7	7	8	15	13	16	18	18	20	19	23	25	26
Food & Textiles	2	3	3	3	3	6	10	8	10	10	8	13	11	13	13
Mathematics & Computing Science	7	10	11	11	12	25	24	27	29	28	32	34	38	40	40
Physics	3	6	3	6	5	12	15	16	14	14	15	21	19	20	19
Technology	3	3	2	2	2	16	16	15	16	15	19	19	17	18	17
Unallocated	0	0	1	1	1	5	4	7	3	3	5	4	8	4	4
Total	22	32	29	34	35	93	95	103	103	102	115	127	132	137	137

## 4. Social and Economic Development

Accounting & Financial Management	9	9	10	11	10	16	15	18	16	16	25	24	28	27	26
Economics	8	8	9	8	7	12	12	14	13	13	20	20	23	21	20
Geography	10	10	10	9	10	11	15	16	13	12	21	25	26	22	22
History & Politics	7	7	7	7	7	15	14	14	13	15	22	21	21	20	22
Land Management	1	1	1	1	1	13	13	14	14	14	14	14	15	15	15
Law	13	13	14	13	16	0	0	2	11	11	13	13	16	24	27
Management & Public Administration	9	11	10	10	11	14	15	15	16	14	23	26	25	26	25
Sociology	5	6	7	6	9	14	15	16	16	18	19	21	23	22	27
Business Studies	0	0	0	0	0	4	3	3	5	4	4	3	3	5	4
Ocean Resources Management Programme	1	2	2	2	3	2	3	3	4	3	3	5	5	6	6
Population Studies	0	0	0	0	0	4	4	4	4	5	4	4	4	4	5
Tourism studies	0	0	1	2	2	3	6	6	7	7	3	6	7	9	9
Social Science	1	1	1	2	2	2	2	2	2	2	3	3	3	4	4
Total	64	68	72	71	78	110	117	127	134	134	174	185	199	205	212

All	137	144	156	165	183	310	319	339	358	380	447	463	495	523	563
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Table2--2 USP Distance Education Enrolments by Level of Programme  
(1994—1996)

1. Preliminary

Courses	1994	1995	1996
Science	8	14	28
Social Science	155	307	242
Unclassified	194	216	359
Total	357	537	629

2. Foundation

Courses	1994	1995	1996
Augmented Science	0	64	54
Augmented Social Science	71	206	215
Science	89	79	97
Social Science	337	186	335
Unclassified	382	479	488
Total	879	1014	1189

3. Certificate

Courses	1994	1995	1996
Accounting Studies	211	243	197
Administration Studies	1	2	1
Advanced Certificate in Teaching Agriculture	0	0	2
Applied Computing	10	9	8
Clothing & Design	4	2	0
Community Development	8	4	4
Computing Studies	2	5	2
Counselling & Guidance	0	0	0
Education	90	57	16
Law	166	215	139
Legal Studies	0	0	48
Library Studies	18	15	19
Management Studies	262	382	323
Non-formal Education	10	8	18
Ocean Resources Management	1	0	1
Population Studies & Demography	3	3	8
Teaching English as a Second Language	112	116	102
Teaching of an Expressive Art	0	1	5
Tourism Studies	7	11	11
Tropical Fisheries	2	2	19
Postgraduate Certificate in Education	55	78	65
Unclassified	60	35	27
Total	1022	1188	1015



#### 4. Diploma

Courses	1994	1995	1996
Accounting Studies	270	235	183
Administrative Studies	9	4	1
Agribusiness	0	2	1
Applied Computing	11	4	3
Applied Statistics & Data Processing	0	1	0
Banking	38	36	22
Community Development	5	5	3
Computing	1	1	1
Early Childhood Education & Development	15	31	27
Economics	23	28	28
Education	60	31	34
Education Evaluation	8	8	8
Educational Administration	62	105	80
Environmental Education	9	7	7
Environmental Health	1	1	2
Fisheries Economics & Management	0	1	0
Guidance & Counselling	5	3	2
Industrial Relations & Personnel Management	4	11	16
Information Systems	0	0	5
Law	0	9	9
Library/Information Studies	121	131	96
Management Studies	110	148	111
Non-formal Education	1	0	0
Ocean Resources Management & Policy	4	2	2
Pacific Language Studies	0	1	1
Population Studies & Demography	2	1	3
Tourism studies	3	6	11
Town Planning	2	4	7
Tropical Agriculture	9	14	16
Tropical Fisheries	2	15	23
Unclassified	78	25	46
Total	853	870	748

#### 5. Degree

Courses	1994	1995	1996
Agriculture	10	17	24
Arts	708	873	805
Arts (Business Studies)	23	24	31
Arts (Land Management & Development)	2	2	2
Education	205	375	392
Law	55	68	66
Science	76	93	86
Science (Environmental Studies)	3	7	2
Technology	0	0	4
Unclassified	555	346	441
Total	1637	1810	1853

Table2-3 USP Distance Education Students by Country  
(1987 - 1996)

Centres	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Cook Islands	171	167	250	200	279	270	158	182	216	136
Fiji	1510	1385	2406	2608	2655	2467	2950	2958	3155	3061
Kiribati	223	290	392	384	370	260	277	303	353	450
Marshall Islands	4	0	0	0	1	0	0	15	37	17
Nauru	119	44	0	44	51	20	40	34	39	46
Niue	12	33	0	22	18	29	28	32	29	15
Solomon Islands	252	346	466	305	297	285	262	279	444	488
Tokelau	36	18	30	20	18	15	13	30	7	32
Tonga	305	289	435	295	192	205	293	340	400	405
Tuvalu	34	56	93	75	61	82	70	82	68	93
Vanuatu	164	226	246	275	222	180	257	218	334	333
Samoa	190	186	294	255	176	191	160	207	274	317
Others	44	55	61	120	115	90	82	68	63	41
Total	3064	3095	4673	4603	4455	4094	4590	4748	5419	5434

Table2-4 Status of USP Centres

Centres	Number of Major Courses	Number of Staff
Cook Islands	6	5
Kiribati	19	7
Marshall Islands	1	2
Nauru	2	4
Niue	0	3
Solomon Islands	17	10
Tokelau	1	1
Tonga	15	12
Tuvalu	6	6
Vanuatu	13	11
Samoa	14	6

(Notes)

- (1) Major courses mean the course with 5 or more enrolments.
- (2) "Unclassified" course in the Preliminary and Foundation is counted as a course.
- (3) "Unclassified" course in the Degree is not counted.
- (4) Fiji centre is excluded from the table.

Table2-6 Comparison between Proposed Design and Alternative Plan

Items	Alternative Plan	Proposed Design
Communication Network	Circuit lease from telecommunication carriers (Lead time required to change network configuration)	Independent dedicated telecommunication network (Flexible to change the network within the earth station's ability)
Required Additional Facility	(1)New dedicated coaxial cable or optical fiber cable between the telecommunication carrier's facility and USP centres	Small earth station for each USP centres
	(2)New circuit termination equipment at the earth station and USP centres	
Radio License	Not required	Required for each earth station before commencement of operation
Certainty of Planned Schedule	Depend on additional investment for required facility by telecommunication carriers (*3)	Independent from telecommunication carriers
Circuit Lease Cost	Fee for international leased line provided by carrier (International and domestic section) (*2)	Lease fee for satellite transponder, only (*1)
Number of Circuits	11 circuits (64kbps both way) 11 circuits (128kbps both way)	11 circuits (64kbps both way), and 4circuits (128kbps one way) or 2 circuits (128kbps both way)
Operation & Maintenance cost	US\$1.6M	US\$0.589M (*4)

(Notes)

(\*1) Lease fee for satellite transponder is US\$0.25M per year

(\*2) Lease fee for 64kbps circuits (both way) in Samoa is about US\$0.048M per year.

If each USP centre (11 stations) lease same 64kbps circuits,

total lease fee will be US\$0.53M on assumption of same fee in each country.

(\*3) Additional facility investment cost in the alternative plan will be charged to USP as initial installation fee and/or lease fee for domestic circuit by telecommunication carriers.

(\*4) Second year from the commencement of operation and later years.

Table2-7 Equipment List for USPNet (Hub Earth Station)

(Fiji)

Facility	Equipment		Qty	Remarks
Antenna	Antenna Structure		1set	
	Feed	Feed Horn	1set	
		Wave Guide for Feeder	1set	
	Drive and Control	Tracking Receiver	1	
		Antenna Control Unit	1set	
		Antenna Drive Unit	1set	
	Antenna Foundation		1set	
Radio Equipment	Radio Frequency	Transmit Power Amplifier	1set	*
		Low Noise Amplifier	1set	*
		Up/Down Converter	1set	*
	Modem	64kbps Modem	11	
		128kbps Modem	3	
		Mother Board	4	
		Control Channel Modem	2	
	Rack, Combiner/Divider		1set	
Circuit Management System	Circuit Management Unit		1set	
	Circuit Control Unit		1set	
Others	Automatic Voltage Regulator (20KW)		1set	
	Multiplexer		1	

\* Note: All radio frequency equipment has one to one redundancy.

Table 2-8 Equipment List for USPNet (Mini-Hub Earth Stations)

(Vanuatu and Samoa USP Centres)

Facility	Equipment		Qty	Remarks
Antenna	Antenna Structure		1set	
	Feed Horn		1set	
	Antenna Foundation		1set	
Outdoor Unit	Power Amplifier		1	
	Low Noise Amplifier		1	
	Frequency Converter		1set	
	Inter Facility Cable		1set	
Indoor Unit	Modem	64kbps Modem	1	
		128kbps Modem	3	
		Mother Board	1	
		Control Channel Modem	1	
Others  (*)	Automatic Voltage Regulator (10KW)		1set	
	Multiplexer		1	
	Desk Microphone		8	
	Speaker		2	
	Amplifier		1	
	Mixer		1	

\*Note: This will be excluded if the Centre has existing equipment.

**Table2--9 Equipment List for USPNet**

( Remote Stations ; Cook Islands, Kiribati, Marshall Islands, Nauru, Niue,  
Solomon Islands, Tokelau, Tonga, and Tuvalu )

Facility	Equipment		Qty	Remarks
Antenna	Antenna Structure		1set	
	Feed Horn		1set	
	Antenna Foundation		1set	
Outdoor Unit	Power Amplifier		1	
	Low Noise Amplifier		1	
	Frequency Converter		1set	
	Inter Facility Cable		1set	
Indoor Unit	Modem	64kbps Modem	1	
		128kbps Modem	2	
		Mother Board	1	
		Control Channel Modem	1	
Others (*)	Multiplexer		1	
	Desk microphone		8	
	Speaker		2	
	Amplifier		2	
	Mixer		1	

\* Note: This will be excluded if the Centre has existing equipment.

Table2-10 Procurement list of Measurement Set and Spare Parts

1. Measurement Set

Measurement Set	Qty
Spectrum Analyzer	2
Frequency Counter / Power Meter with Sensor	2
If Attenuator	2set
RF Attenuator	2set
Digital Transmission Tester	4
Synthesized Signal Generator	2
Testing Cable, Adapter	2set

2. Spare Parts

Station	Facility	Name of Spare Parts	Qty
Hub Station	Antenna	Feed Cover for 7.6 meters Antenna	1
		Silikagel for Dehydrator	1
	Radio	Low Noise Amplifier (noise temperature : 37K)	1
		High Power Amplifier (100W SSPA)	1
		Up Converter	1
		Pilot Oscillator	1
		Down Converter	1
		Automatic Frequency Control / Automatic Gain Control Card	1
		Data Channel Modem	2
		Control Channel Modem	1
Mini-Hub Earth Station	Outdoor Unit (50W SSPA, 35K LNA, Up/Down Converters)		1set
	Antenna	Feed Cover for 4.5 meters Antenna	1
		Silikagel for Dehydrator	1
	Indoor unit	Data Channel Modem	1
		Control Channel Modem	1
Common Spares for Remote Earth Stations	Outdoor Unit (20W PA, 60K LNA, Up/Down Converters)		1set
	Antenna	Feed Cover for 4.5 meters Antenna	1
		Silikagel for Dehydrator	1
	Indoor unit	Data Channel Modem	1
		Control Channel Modem	1



Table 3-3 Implementation Schedule (Fiji)

[illegible]

Table 3-4 Implementation Schedule (Samoa)

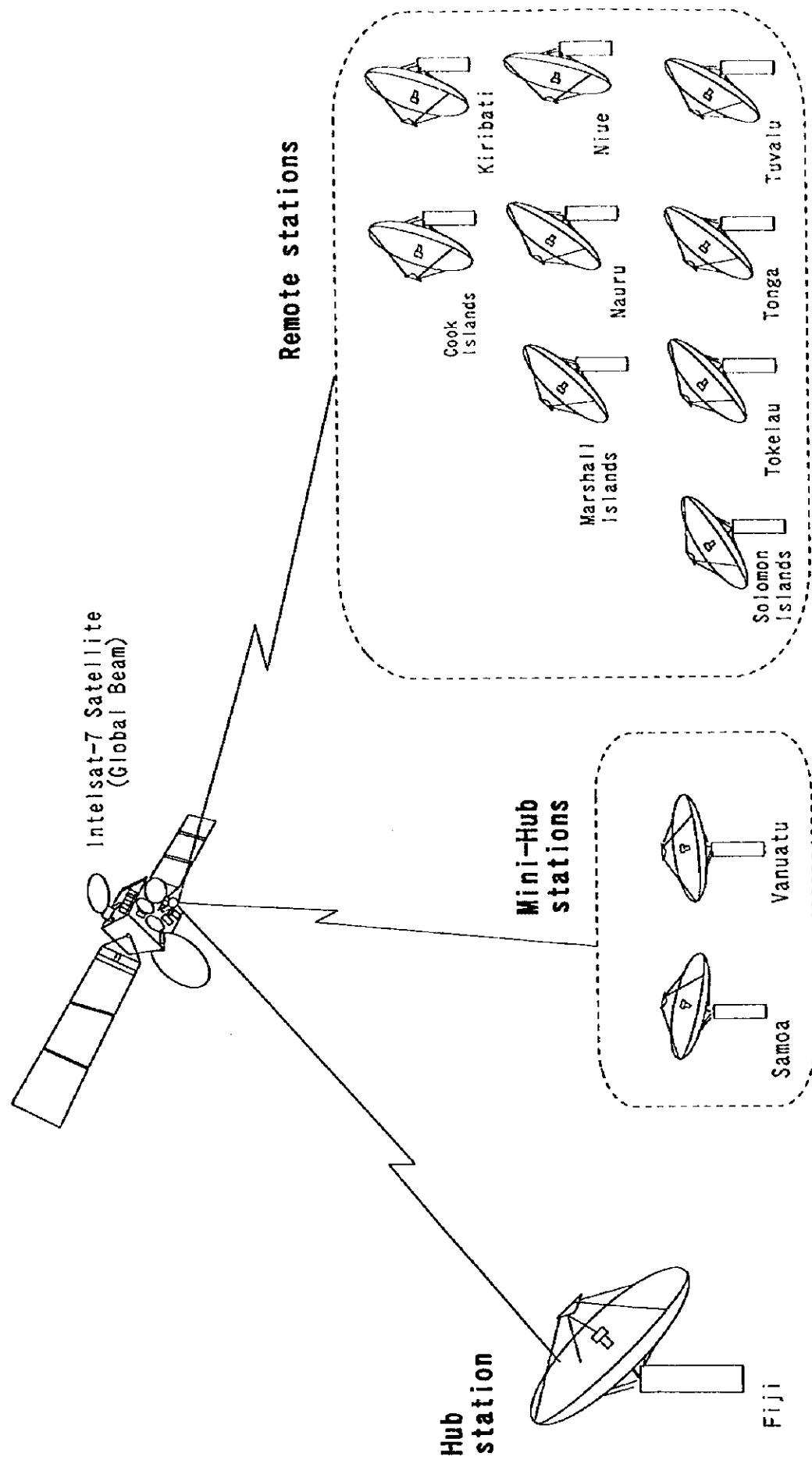


Figure 2-1 USPNet System Configuration

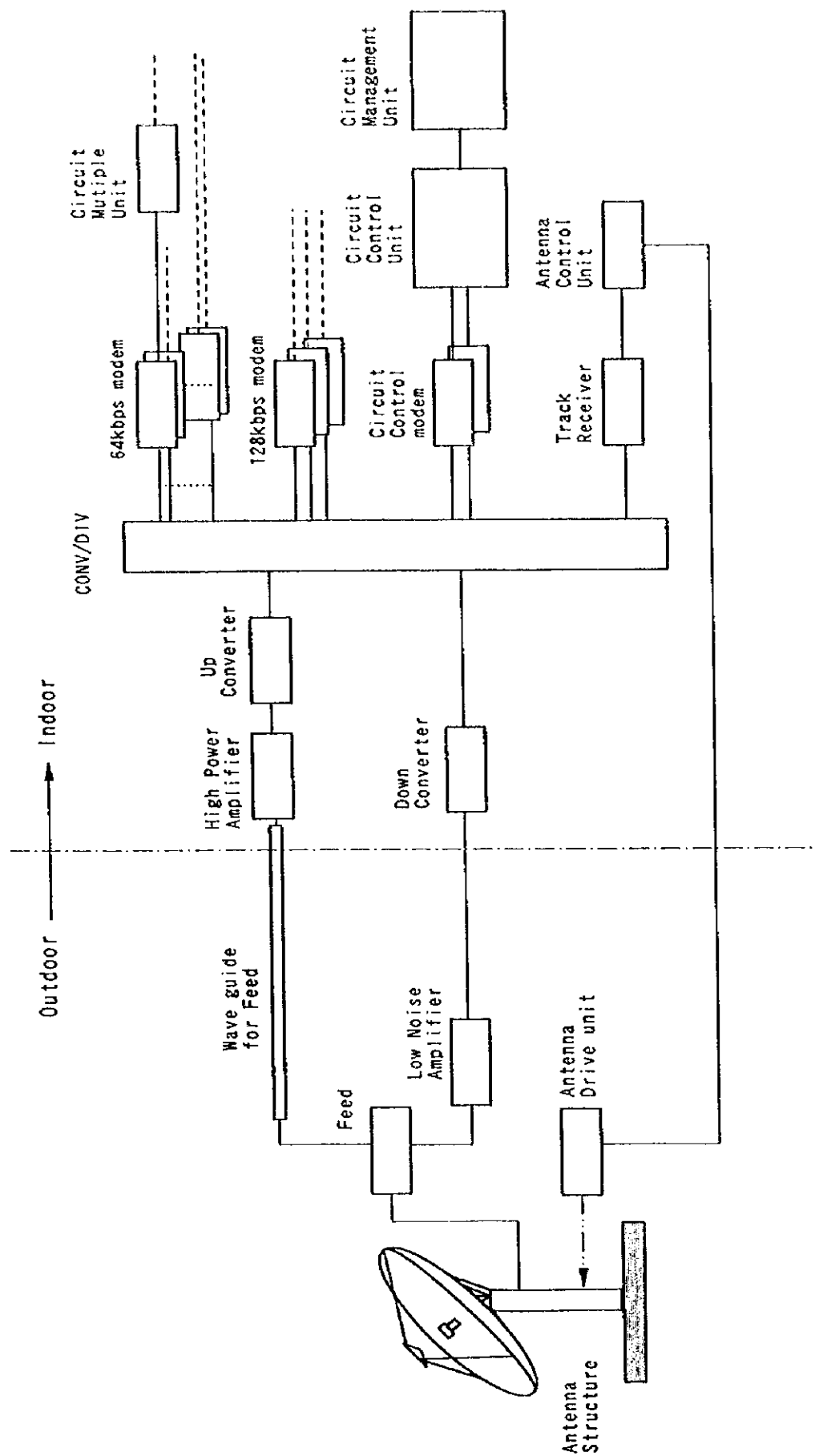


Figure 2-2 Configuration of Hub Station

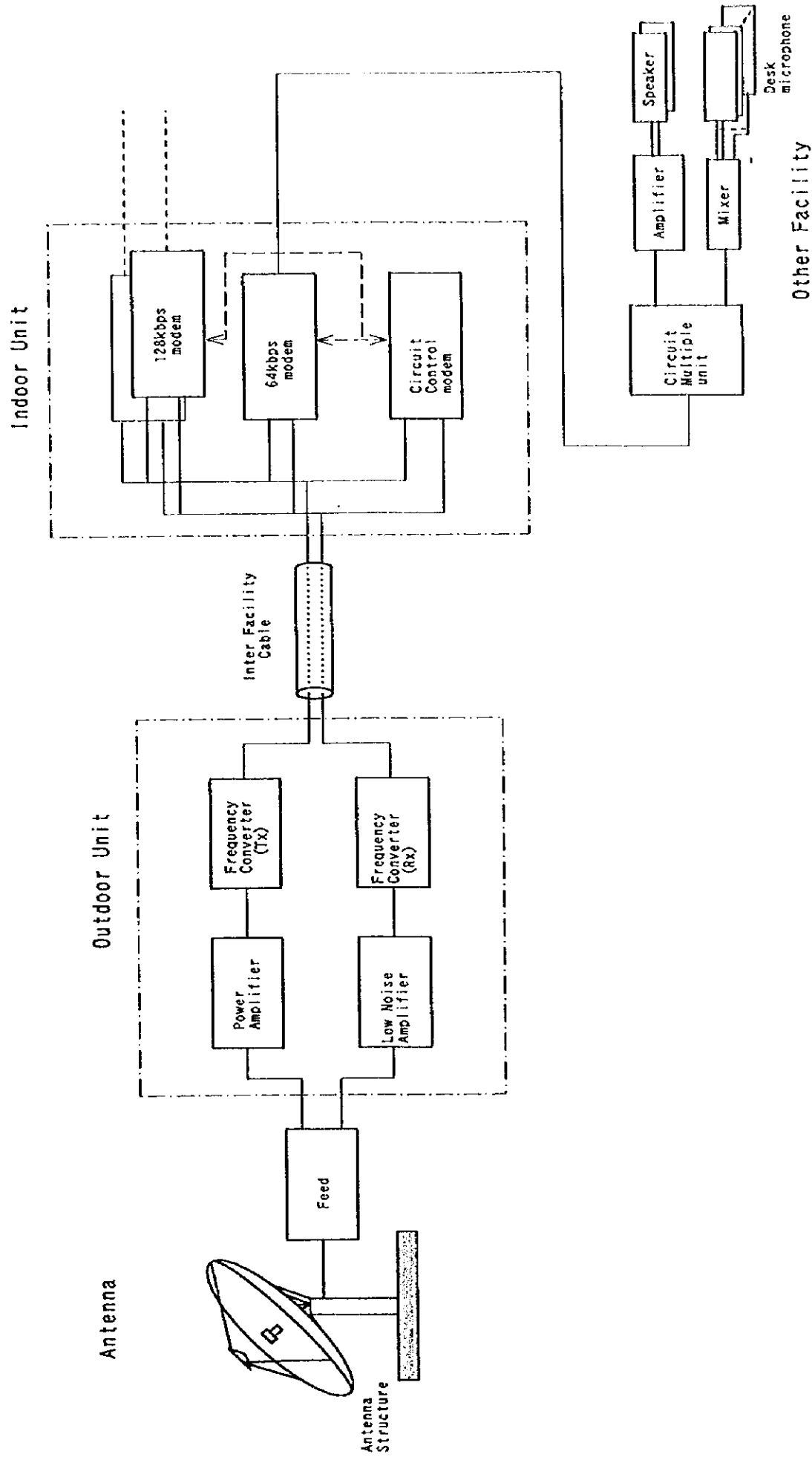


Figure 2-3 Configuration of Mini-Hub and Remote Earth Stations

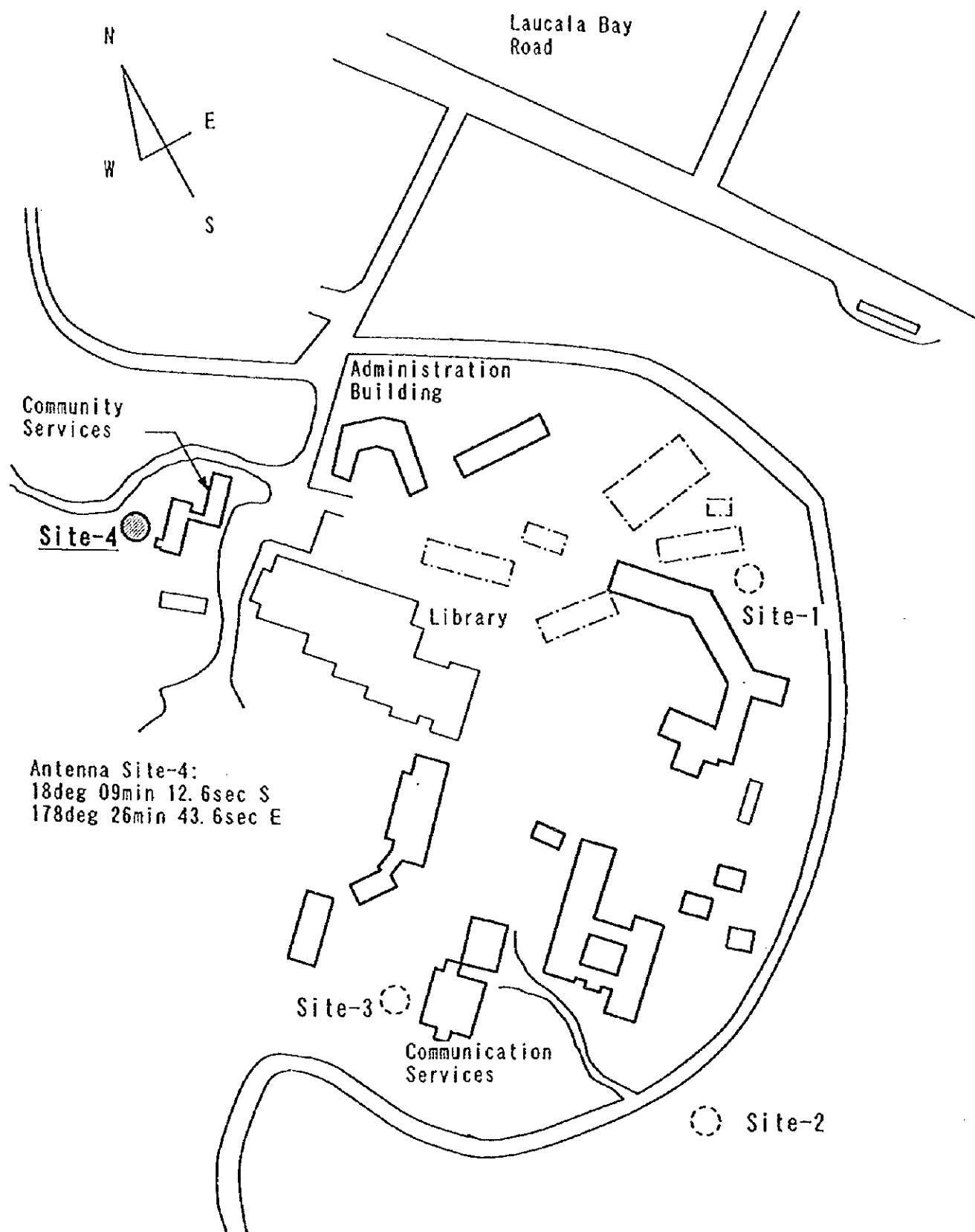


Figure 2-4 Site Layout for USP Headquarters in Fiji

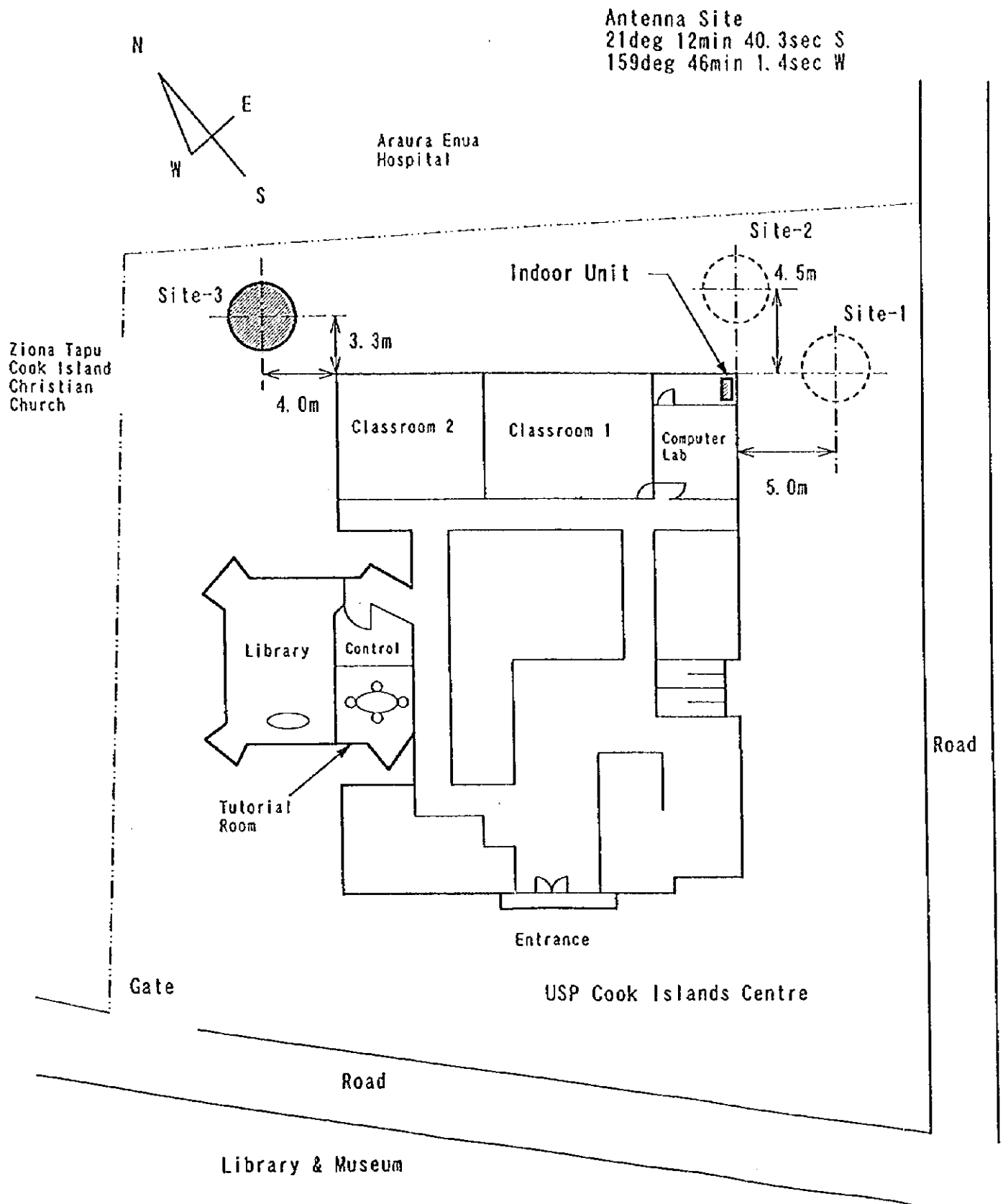


Figure 2-5 Site Layout for USP Cook Islands Centre

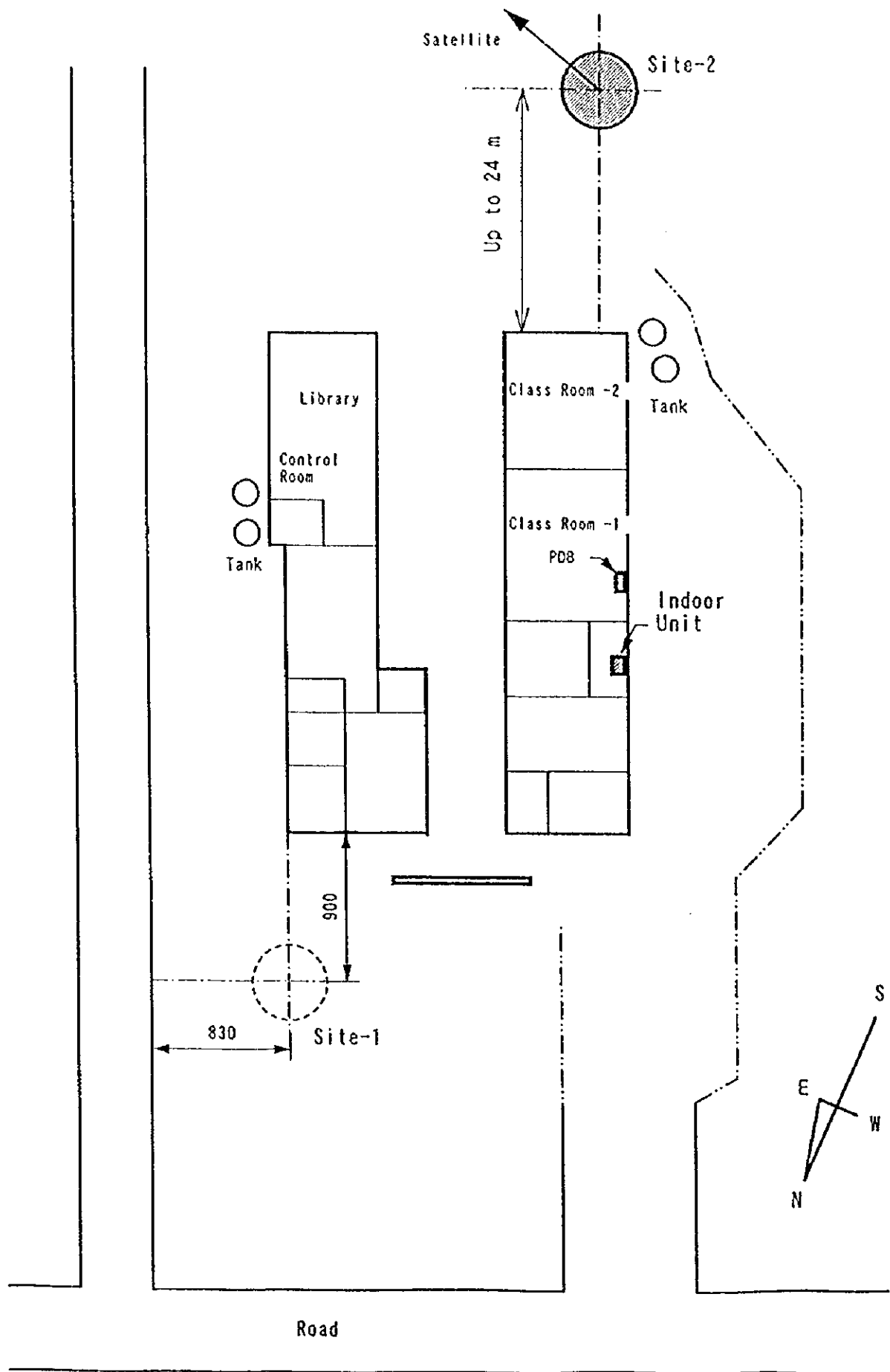


Figure 2-6 Site Layout for USP Kiribati Centre



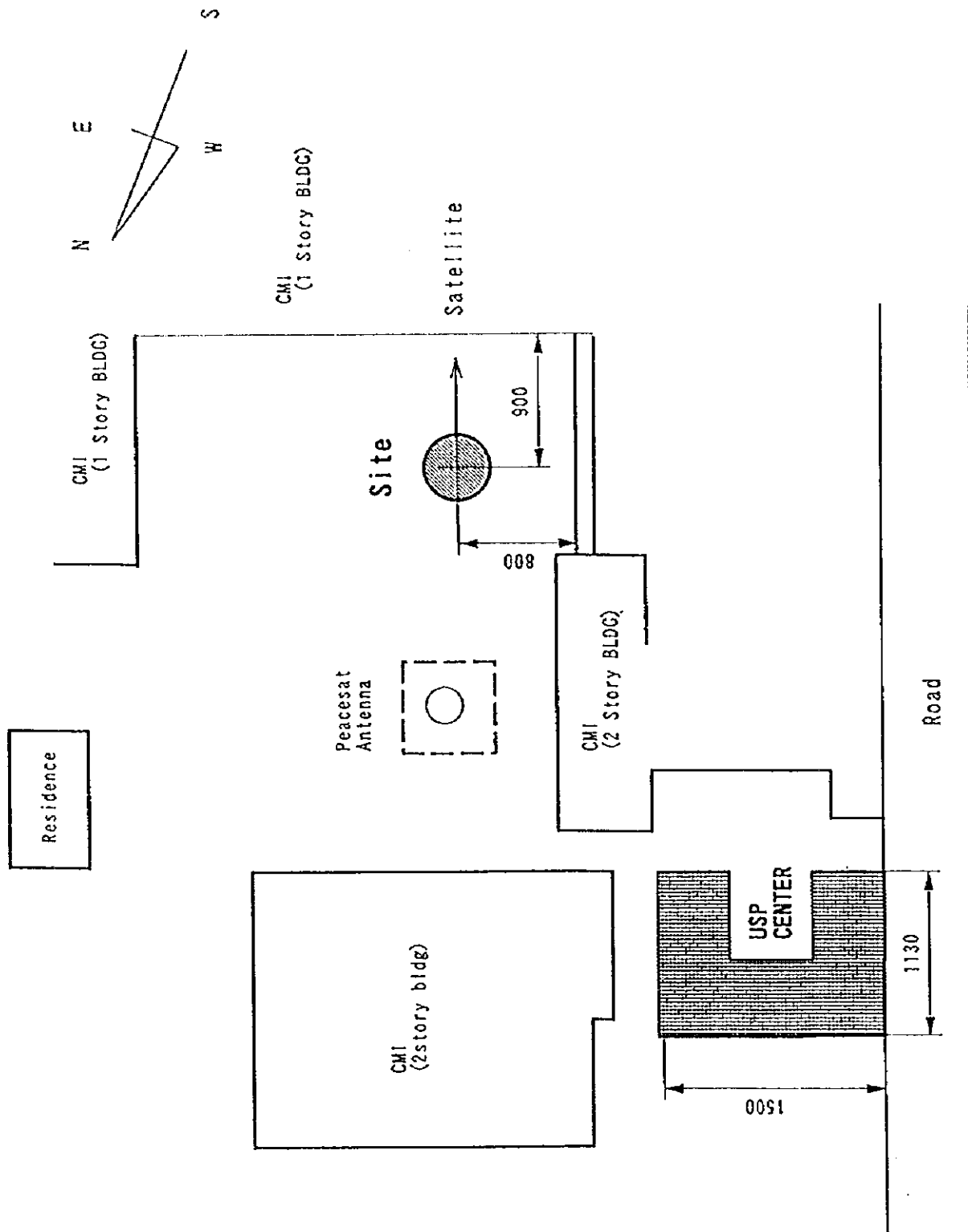


Figure 2-7 Site Layout for USP Marshall Islands Centre

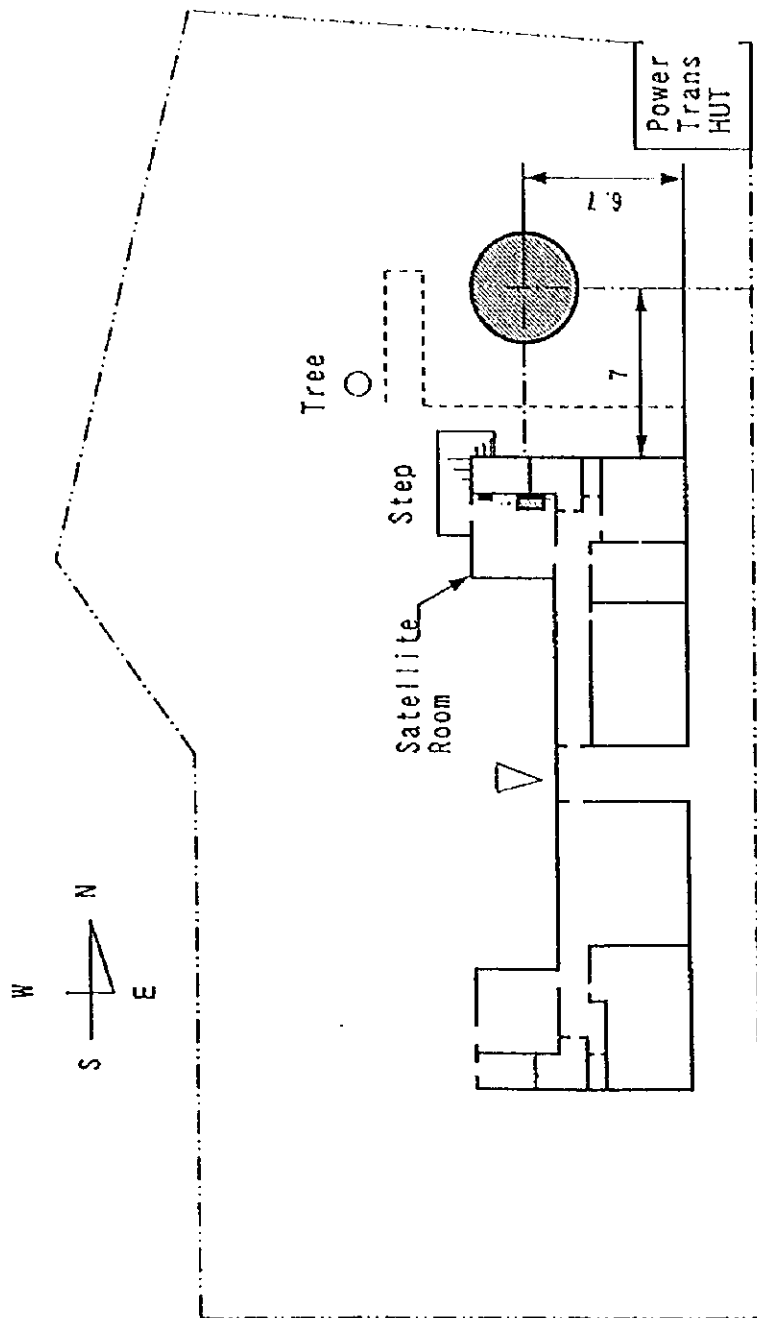


Figure 2-8 Site Layout for USP Nauru Centre

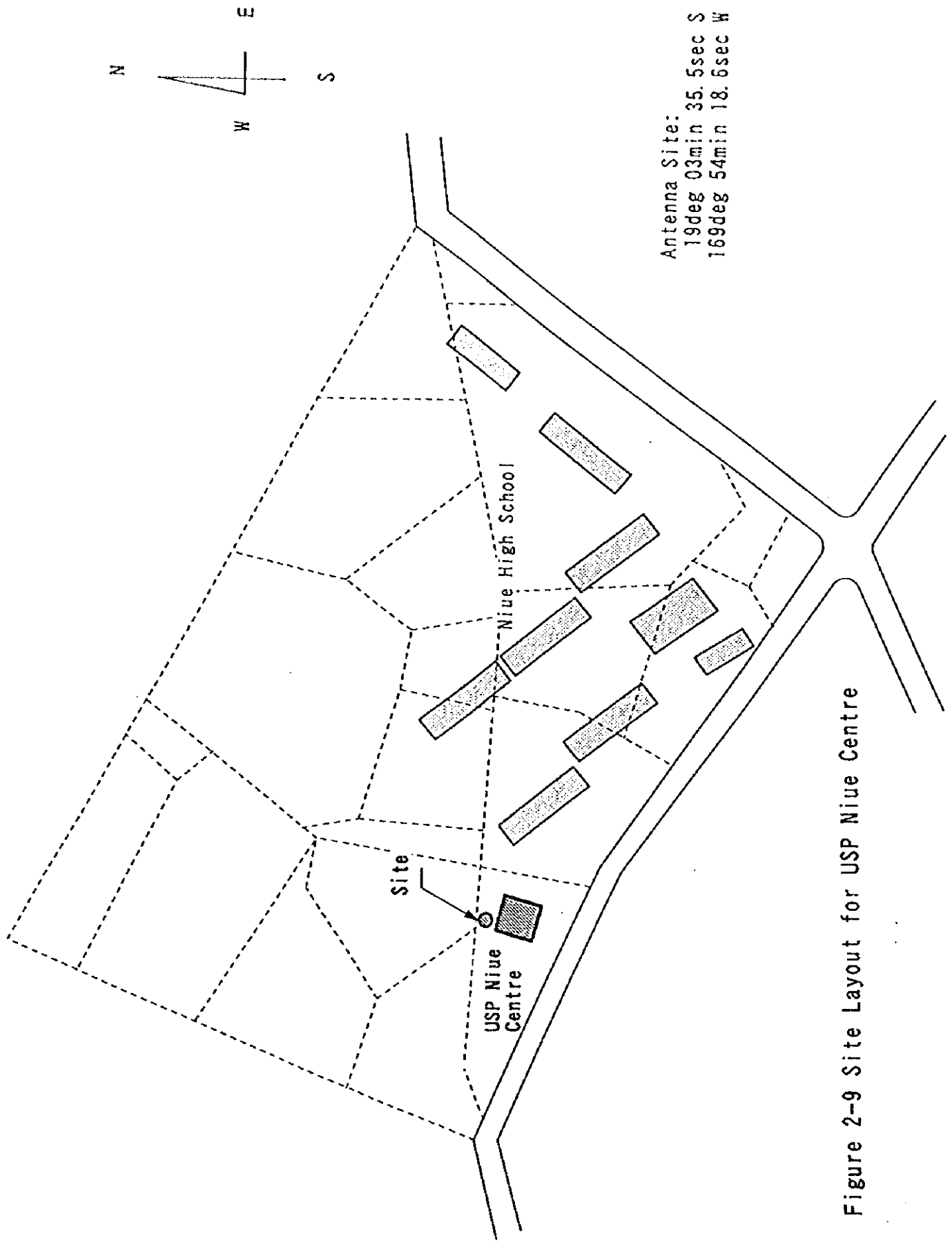


Figure 2-9 Site Layout for USP Niue Centre

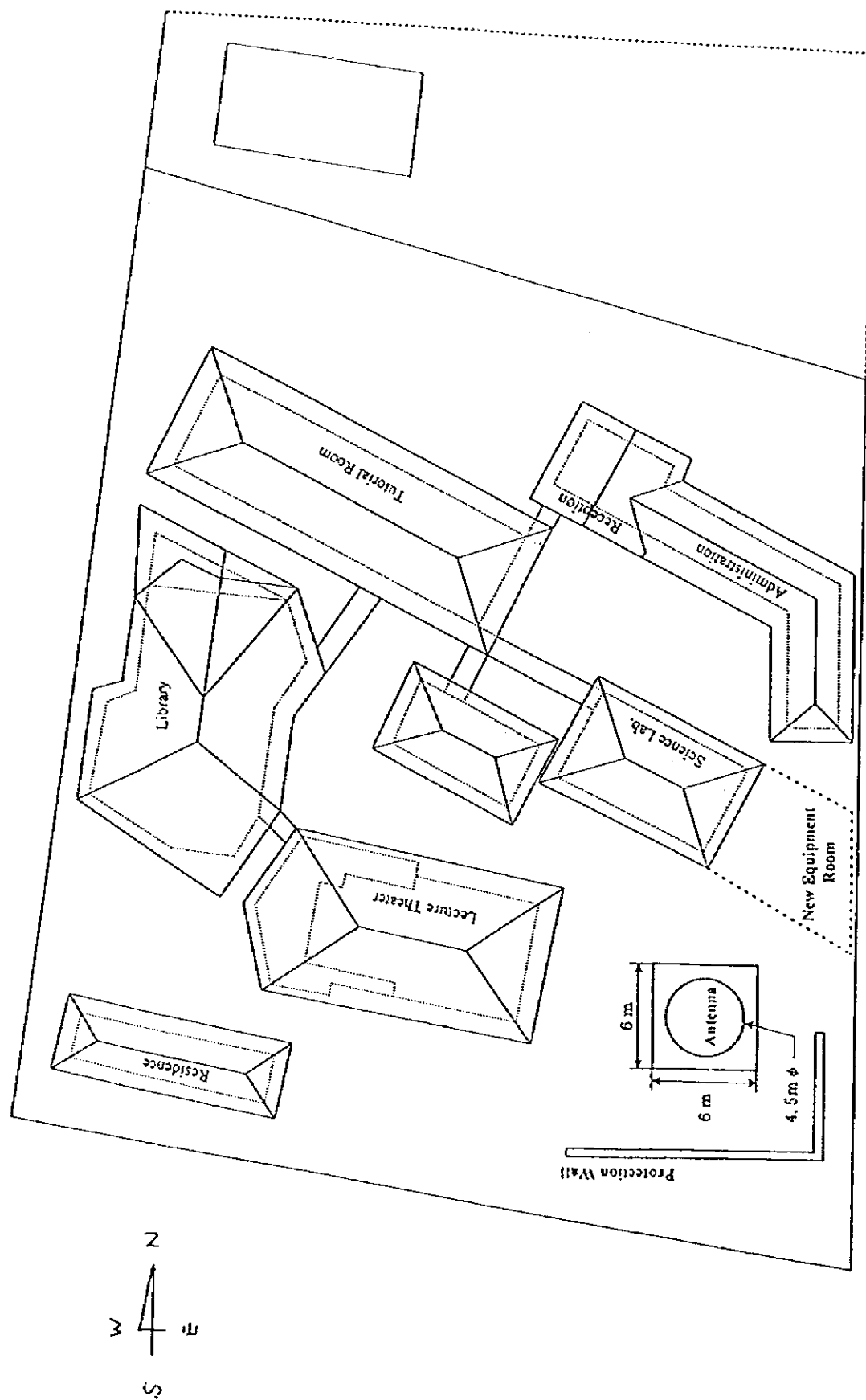


Figure 2-10 Site Layout for USP Solomon Islands Centre

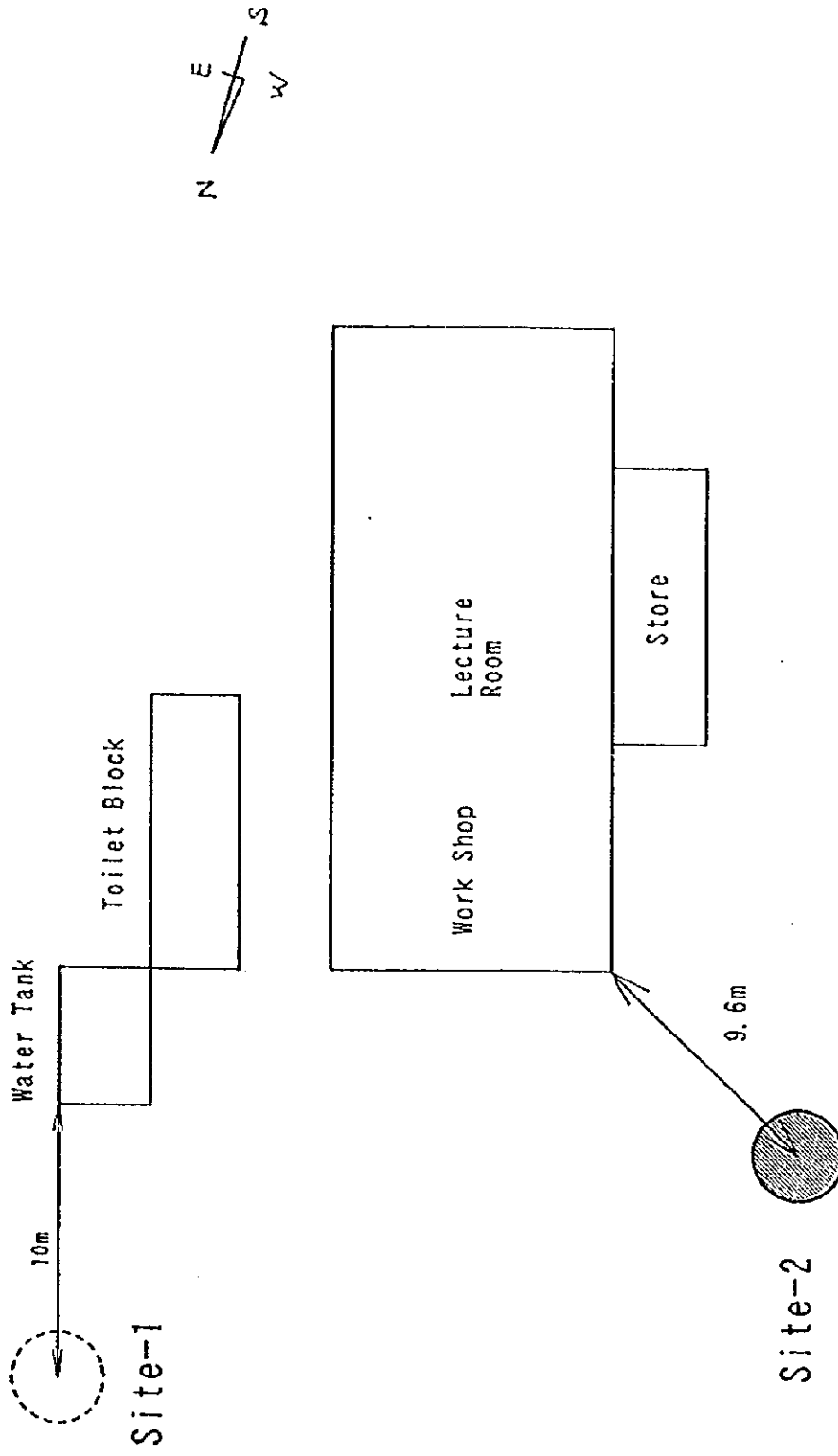


Figure 2-11 Site Layout for USP Tokelau Centre

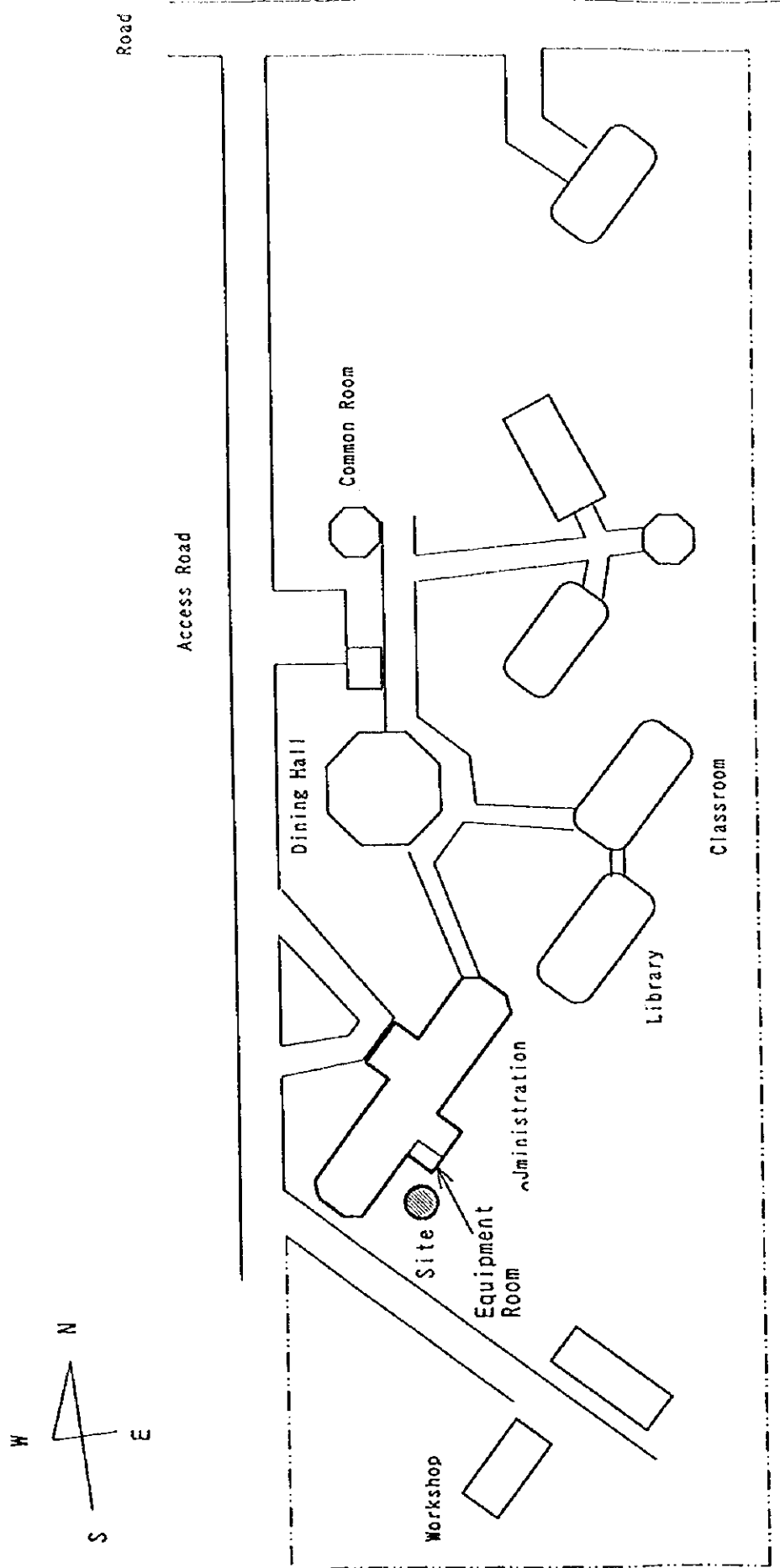


Figure 2-12 Site Layout for USP Tonga Centre

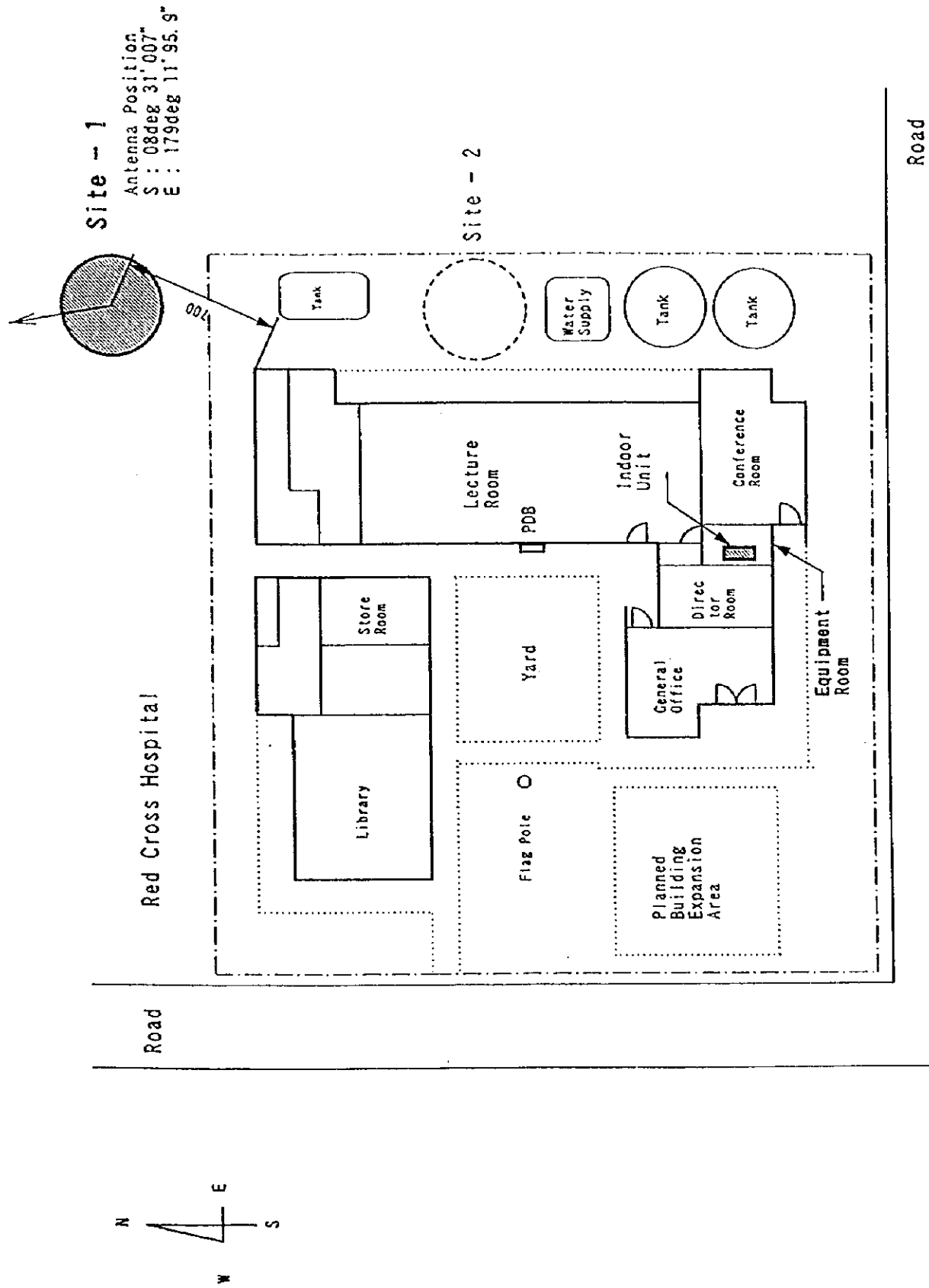


Figure 2-13 Site Layout for USP Tuvalu Centre

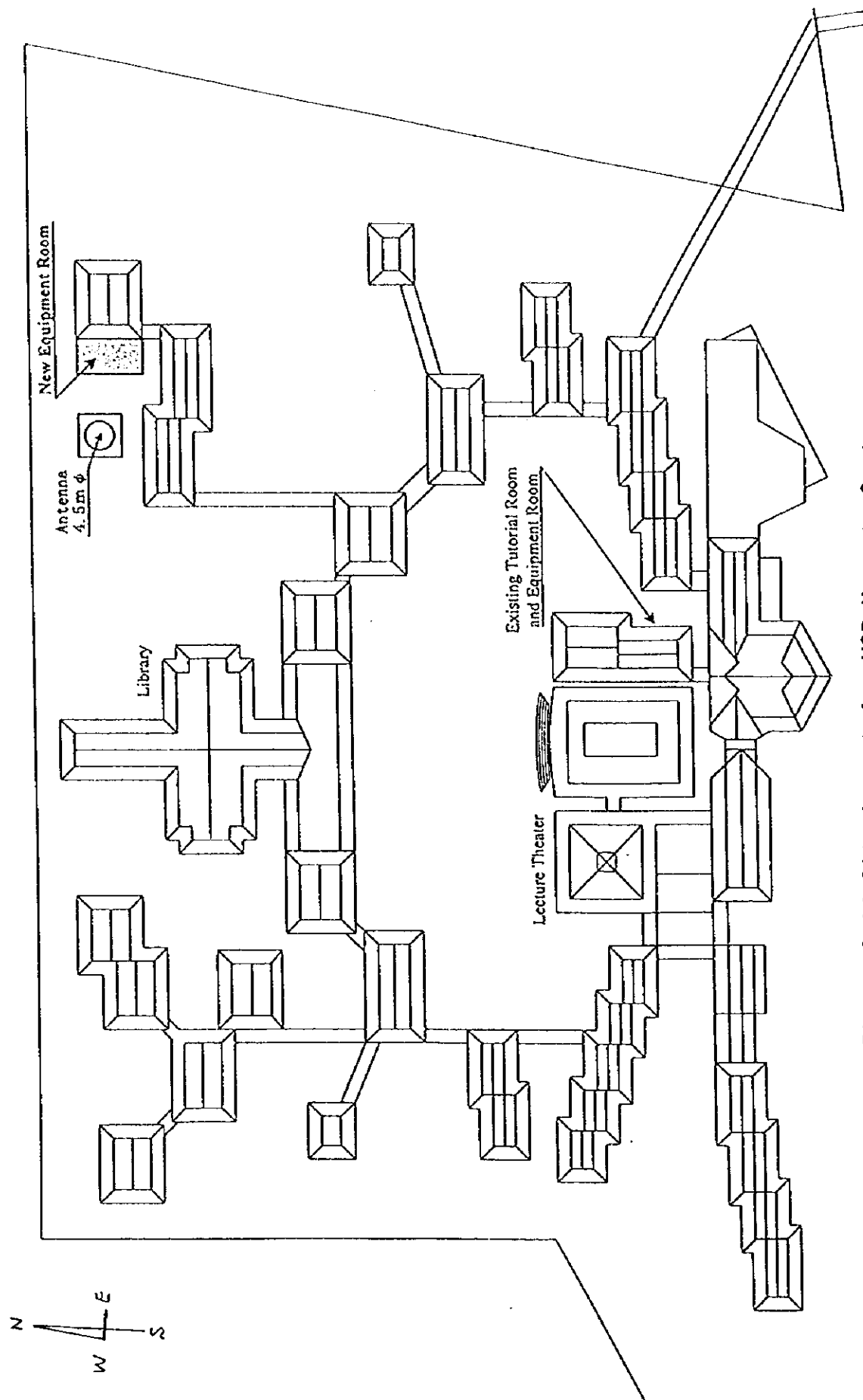


Figure 2-14 Site Layout for USP Vanuatu Centre



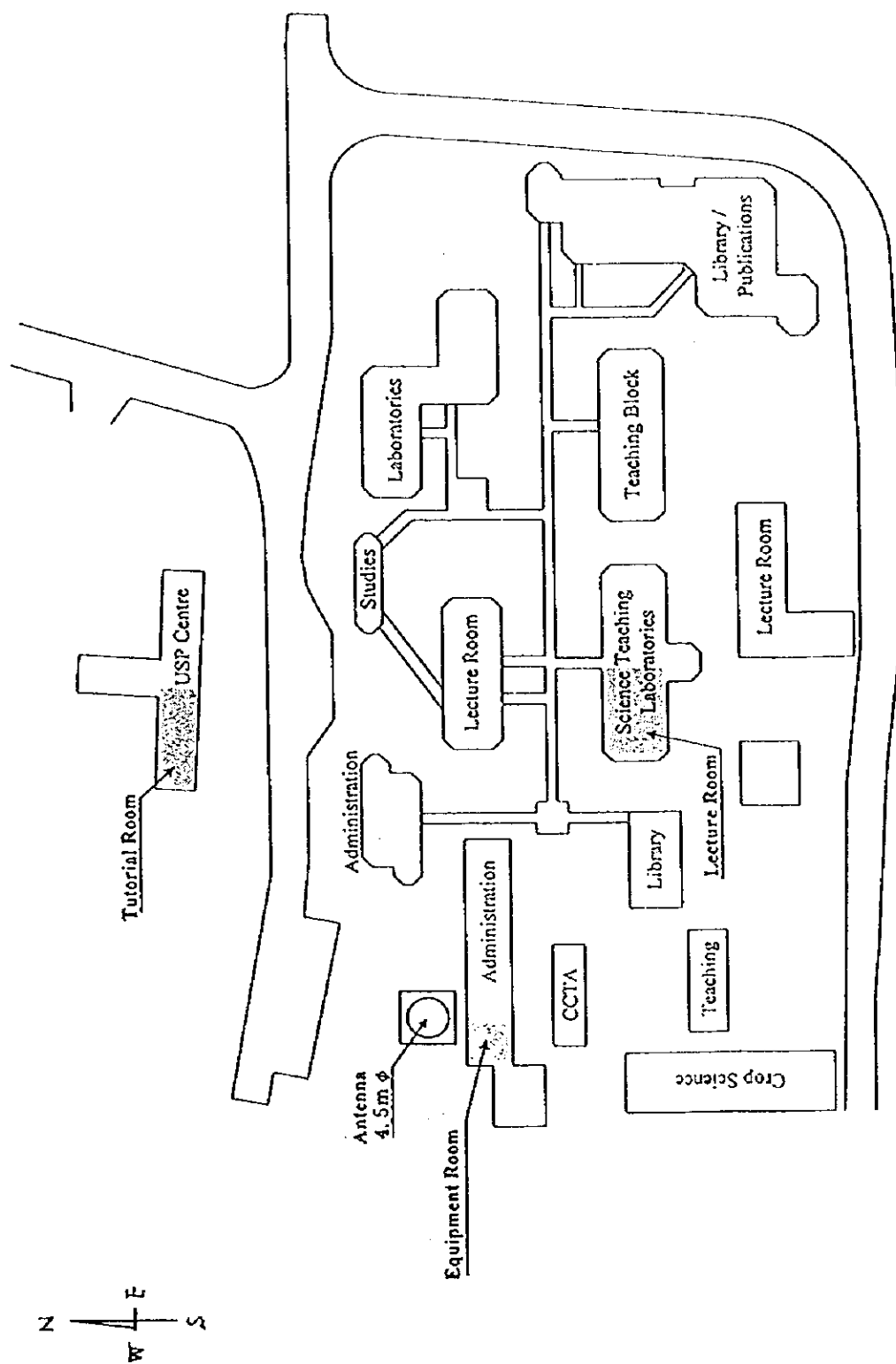


Figure 2-15 Site Layout for USP Samoa Centre

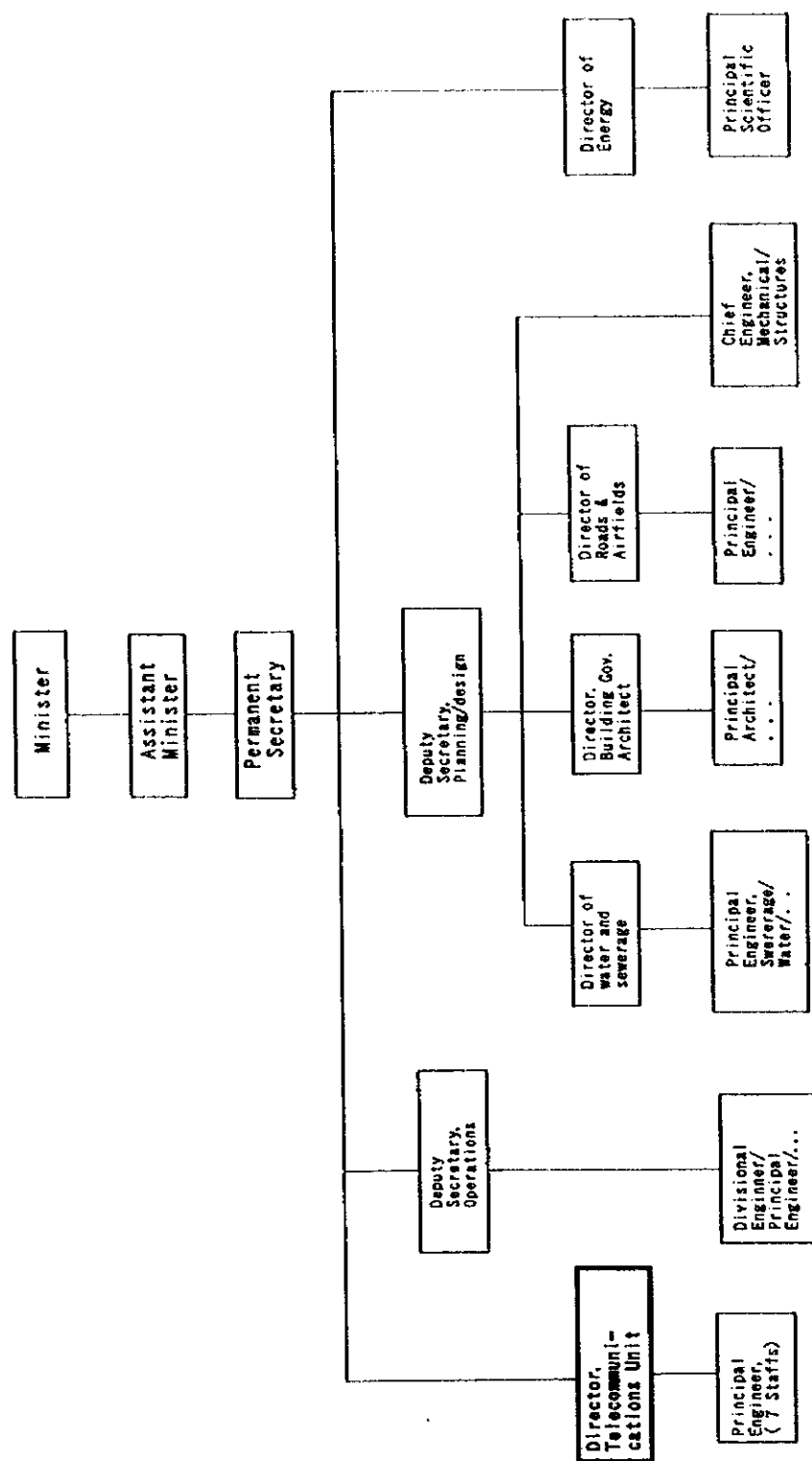


Figure 2-16 Organization Chart of Ministry of Communications, Works and Energy in Fiji

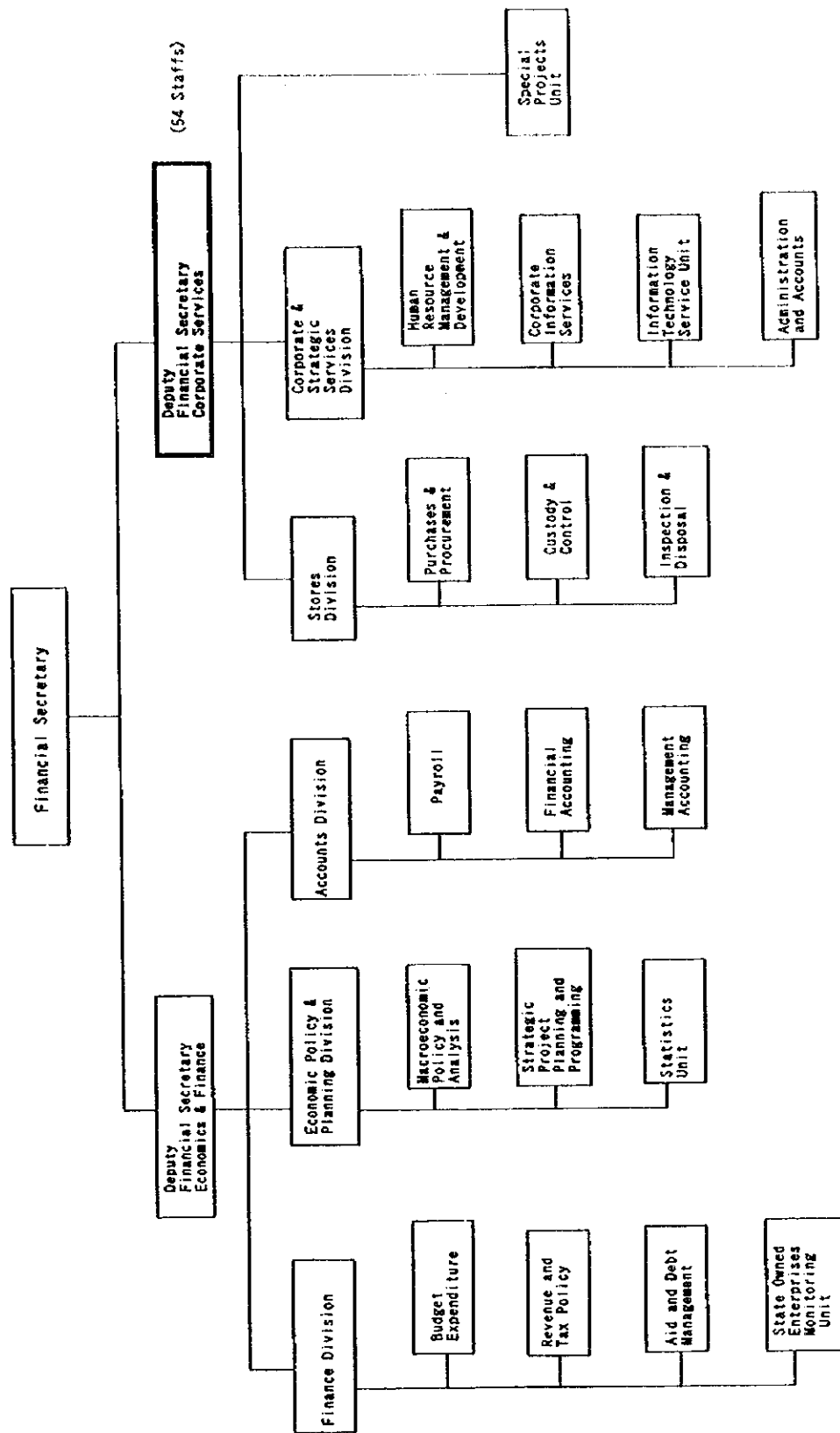


Figure 2-17 Organization Chart of Treasury Department

(\* 1) : in Samoa,  
 (\* 2) : in Vanuatu,  
 Others are in Fiji

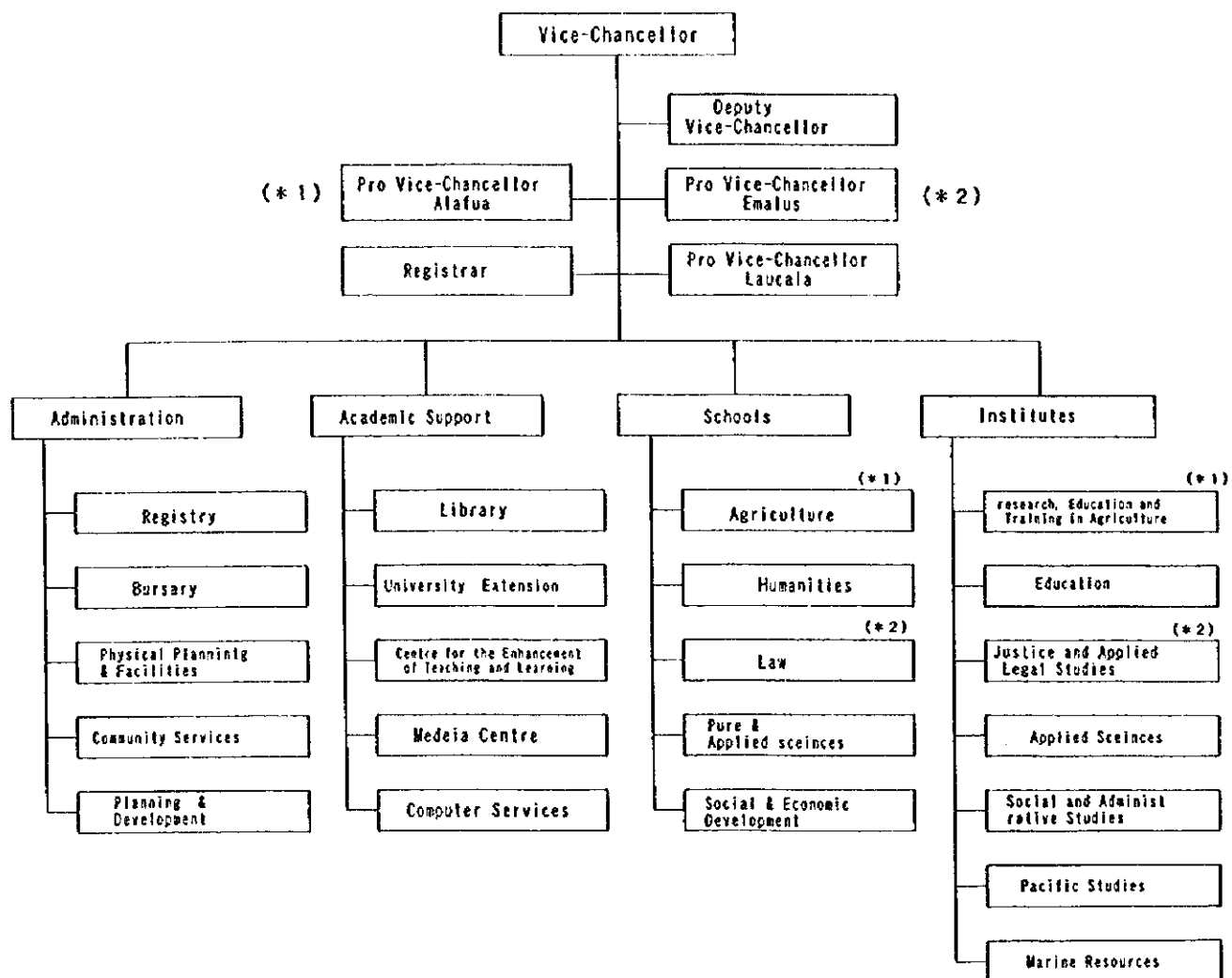
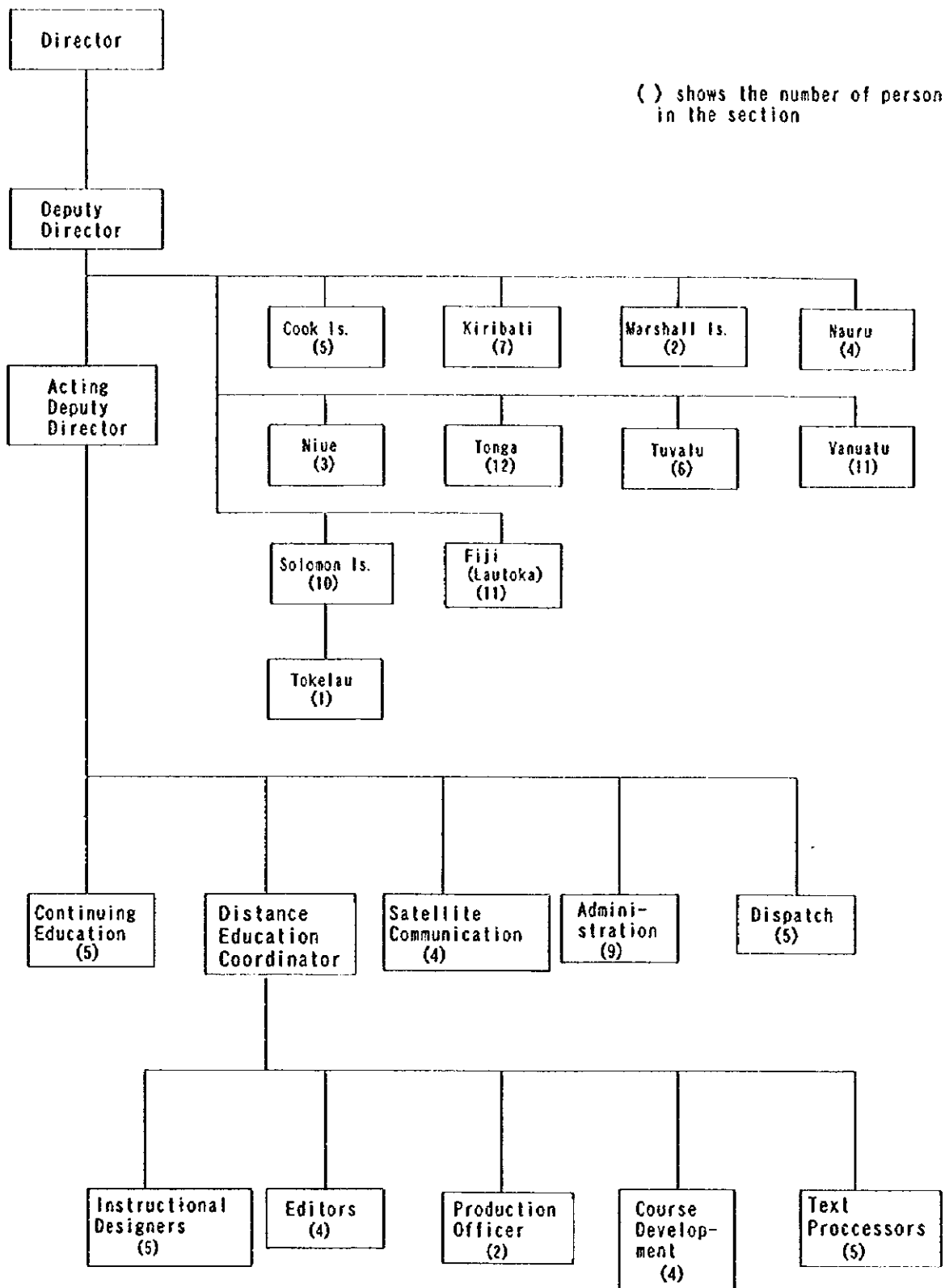


Figure 2-18 Organization Chart of USP



(University Extension Handbook 1997)

Fig 2-19 Organization Chart of University Extension