The Republic of Fiji
Ministry of Education, Heritage & Arts
The University of the South Pacific (USP)

PREPARATORY SURVEY REPORT
ON
THE PROJECT
FOR
ENHANCEMENT OF USPNET COMMUNICATION SYSTEM
IN
THE REPUBLIC OF FIJI

JUNE 2018

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

YACHIYO ENGINEERING CO., LTD.

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Summary

① Overview of the Country

The Republic of Fiji (hereinafter referred to as "Fiji") is an island country located in the position of 180 ° west / east longitude and 18 ° south latitude in the South Pacific. Fiji consists of about 330 islands and the total area of the land portion is 18,270 km^2 (Source: World Bank, 2016). Viti Levu, the largest island in Fiji in which the capital city Suva is located, and neighboring Vanua Levu are main islands. Both islands have mountains more than 900 m, which affect the climate in Fiji. The population in Fiji is about 885 thousands (Fiji Bureau of Statistics, 2018) and the ethnic composition is Melanesian (57 %), Indian (38 %) and others (5 %) (Fiji Bureau of Statistics, 2007). Melanesian, Polynesian, Indian and other cultures are existing together and creating a unique culture. Main industries of Fiji are exporting industries such as sugar and fish and shellfish and tourism industry such as marine resort utilizing abundant marine resources. GDP of Fiji is USD 4.7 billion (World Bank, 2016). The industrial structure is 10.7 % among GDP for primary industry (Agriculture, Forestry and Fisheries), 18.0 % for secondary industry (including mining and electricity) and 71.3 %, occupying large proportion, for Tertiary industry (Tourism etc. service related). (CIA-The World Factbook, 2016)

② Background and Outline of the Project

The University of the South Pacific (hereinafter referred as to "USP") which has the administrative building of the university in Suva, the Republic of Fiji (hereinafter referred as to "Fiji"), is an international higher education institution which was founded in 1968 by the governmental investment from countries of the South Pacific region. Human resource development is an important measure for sustainable economic growth in the Pacific Island countries and improvement of living standards of the people. In Japan's business expansion plan toward Fiji (as of April 2016), Pacific Leader's Educational Assistance for Development of State is planned. USP accepts students sent abroad from surrounding countries, and moreover, provides higher education service through distribution of distance learning in consideration with the geographic situation. USP is commonly operated among 1) Cook Islands, 2) Fiji, 3) Republic of Kiribati, 4) Republic of the Marshall Islands, 5) Republic of Nauru, 6) Niue, 7) Independent State of Samoa, 8) Solomon Islands, 9) Tokelau, 10) Kingdom of Tonga, 11) Tuvalu, 12) Republic of Vanuatu as of 2017. USP provides distance learning service for campuses / centres in member countries and regions using satellite communication system (hereinafter referred to as "USPNet") which its operation was commenced by the support of the Government of Japan, New Zealand and Australia in 2000. On the other hand, many equipment of USPNet of the hub station in the administrative building, Laucala campus, have not been updated since the commencement of its operation, therefore USP is worried about the interruption of distance learning caused by aged deterioration of the equipment. Following this situation, in November 2013, JICA implemented the follow up cooperation for "The Project for Upgrade of USPNet Communications System" in Fiji and suggested the implementation of a new project using Grant Aid cooperation. USP has various issues such that employment rate of its students and graduate students is low, assistance for students of member countries and regions, for example additional educational programme, is not enough, and so on.

These issues are shown in Strategic Plan 2013 - 2018 and the like, and the objective "realizing enough ICT supply in accordance with the needs of the university" is mentioned in Strategic Plan 2013 - 2018. Under the circumstances above, the Government of Fiji submitted the request form for Grant Aid to the Government of Japan. Table-1 shows requested items stated in the form on the date 10th April, 2017.

Table-1 Items stated in the request form from the Ministry of Foreign Affairs in Fiji

Item	Request
Facilities	New HUB Earth Station Building
Equipment	Antenna & Related RF Systems
	iDirect Baseband Hub System
	Building Systems (Power / AC / Access / ICT)
Soft components	

The Project aims at making distant learning continuously distributed by updating equipment of the hub station, which will result in providing higher education service to the Pacific Island countries. The overall goal of the Project is "to provide the distance learning services for higher education to other USP member countries and regions and to provide support in their maintenance and management". In addition, the objective of the Project is "to revitalize and improve the functioning of the distance learning networks".

③ Outline of the Result of the Survey and Contents of the Project

JICA twice dispatched the survey team (hereinafter referred to as "JICA Project Team") to Fiji for outline design of the Project. (1st field survey was from 13th June to 4th July in 2017, and 2nd was from 4th to 11th December in 2017.) JICA Project Team heard contents requested for the Project and implemented on-site survey at the targeted site for installation of equipment As a result, the situation regarding existing equipment such as C-band communication satellite and the like was confirmed. In general, it is said that each of these equipment has a useful life of 10 to 15 years, therefore, there is a possible risk on interruption of satellite communication caused by aged deterioration of the equipment, that is, interruption of distance learning. It is expected that updating all equipment of the hub station will ensure the stability and reliability of the satellite communication system.

The satellite communication lines currently used by USPNet consists of C-band 15MHz bandwidth of European communication satellite and Ku-band 5MHz bandwidth of US communication satellite. Two (2) satellite communication lines are used and each usage fee occurs. In addition, there are duplication of expenses for maintenance and management of the equipment for connection with each communication satellite. In the Strategic Plan 2013 - 2018, USP mentions the necessity for improvement of the speed of satellite communication lines in order to deal with increase in the number of students and diversification of educational services in future. However, the speed of the communication lines have not become faster and their capacities have not become larger, because the bandwidth ensured by current contract for satellite communication lines cannot be expanded due to financial restrictions. Under these circumstances, the Project will consolidate two communication satellites currently used by USPNet into Ku-band in order to reduce maintenance and management costs and will make a plan for achieving system capable of supporting communication with higher speed. In the 1st field survey as outline design of the Project, JICA Project Team discussed with the Fijian side about various perspectives of technical aspect, expense,

capacity of maintenance and operation and so on, and the appropriate plan for equipment procurement was established. Table-2 shows the draft of the Project component.

Table-2 Project Component (draft)

1. Procurement of the Equipment (1) Procurement of the Equipment 1) Parabolic Antenna System 2) Low Noise Converter System 3) Block Up Converter System 4) Baseband System 5) Monitoring and Control System for Hub Station 6) Uninterruptible Power Supply (UPS) 7) Lightning Protection Device 8) Measuring Instrument 9) Spare Parts 10) Consumable Parts (2) Installation works of the Equipment 1) Construction of New Hub Station Building 2) Construction of Parabolic Antenna Foundation 3) Installation of Equipment 4) Adjustment and Testing (3) Initial operation and maintenance training by the Supplier
2. Consulting Services (1) Detailed Design, bidding and supervision (2) Soft Components (Assistance in the start-up or operation and maintenance) 1) Transition into New System / Daily Operation Technology 2) Satellite Communication Link Usage/Application Technology

Ministry of Education, Heritage & Arts is the organization responsible for the Project on the Fijian side and USP is the executing agency. Implementing the Project will be beneficial for about 11,300 students (approximately 49% of all students, from 2013 to 2017) taking distance learning at campuses / centres in 12 member countries and regions.

④ Period of the Project and Cost Estimation

Total required period of the Project is 18 months, including detailed design, bidding and installation work, based on the guideline for Grant Aid of Japan. Total project cost is estimated to be 913 million yen on the Japanese side including equipment procurement fee and equipment design supervision cost, and 475 million yen on the Fijian side, which will be mainly used for usage fee of satellite communication line. The fund from the Government of New Zealand will be used for replacement of remote stations.

⑤ Background of the Suspension of the Project

(1) Situation as of the 1st Field Survey

1) Confirmation of Work Demarcation Regarding USPNet with the Delegation from the Government of New Zealand (20th June, 2017)

JICA Project Team discussed with the delegation from the Government of New Zealand (the Ministry of Foreign Affairs and Trade and the Consulate of New Zealand in Fiji) and confirmed the content of the Activity Design Document which USP is implementing with the assistance of the Government of New Zealand. In addition, it was confirmed that USP and the Japanese side would go ahead the work relating to USPNet on the basis of the demarcation as shown in Table-3.

Table-3 Demarcation of works between Japanese side and USP side

No.	Work item	Japanese side	USP side (using funds from New Zealand)	Remark
1	Repair of existing C-band antenna		○	Short-term undertaking
2	Planning for updating existing hub station	○		Medium- to long-term undertaking
3	Update and repair of remote stations in member countries and regions of USP		○	

2) Confirmation of Request by USP (23rd June, 2017)

JICA Project Team discussed with USP and confirmed that the requested items in the Project are the New Hub Station Building, equipment for the hub station, and soft components relating to operation and maintenance of the equipment. In addition, it was also confirmed that USP has the desire to operate USPNet using multiple hub stations (secondary Hub Station) in order to ensure redundancy in the system. The details of this discussion are given in the minutes of the discussion (M/D).

In addition, JICA Project Team suggested the future grand design of USPNet, aiming at effective usage of frequency bandwidth by integrating communication satellites currently used in USPNet into one Ku-band system, reduction of costs for USPNet, duplication of hub stations and the like. Table-4 shows the intention of USP to suggested points by JICA Project Team.

Table-4 Suggestion for improvement of USPNet

No.	Suggestion	Merit	Intention of USP
1	Integration of communication satellite of USPNet into one system	Effective usage of frequency bandwidth by changing the operation of USPNet from using two satellites (C-band and Ku-band) into one satellite (Ku-band), which will lead to reduction of operation cost.	In addition to the merit mentioned in the left, Ku-band can reduce the size of antennas at remote stations, which will enable students, who cannot commute to campuses/centres easily, to take distance learning classes at their houses by installing small-sized antennas at their houses.
2	Duplication of hub stations	Dispersing the risk of suffering damage from disasters such as cyclones and earthquakes by	USP has been considering duplication of hub stations of USPNet, by establishing the

No.	Suggestion	Merit	Intention of USP
		deploying the secondary Hub Station at another distant campus. It is also expected that the link availability will be improved because USPNet can continue its operation during maintenance of hub stations.	secondary Hub Station in either Tonga, Vanuatu, Marshall Islands or Samoa which are connected with Fiji via optical submarine cables.
3	Future grand design for USPNet	Enabling overall design aiming at enlarging capacity for contents of USPNet as a medium- to long-term undertaking, in consideration with increase of the number of students in future.	USP hopes that Japanese side will prepare overall design of USPNet, same as 2000 when USPNet was introduced.

3) Confirmation of Technical Specifications of the Equipment to be Procured in the Project (3rd July, 2017)

JICA Project Team prepared the Field Report (Appendix-8) to confirm the technical specifications of the Equipment to be procured in the Project and explained these to the ITS group, which is the contact group for technical coordination at USP. Then the ITS group agreed that JICA Project Team will prepare the cost estimation of the Project and the draft specification of the Equipment in accordance with the Field Report.

(2) Request from Fiji as of the 2nd Field Survey

1) Explanation on Contents of the Project from JICA Project Team to USP (5th December, 2017)

JICA Project Team and Vice-Chancellor & President of USP (hereinafter referred to as "VC") confirmed issues regarding USPNet such as its cost, additional introduction of a new distance learning programme, deterioration of the equipment, etc. In order to solve the issues, JICA Project Team also explained the basic conception to integrate the system of USPNet into the type of using only Ku-band from that of currently using both C-band and Ku-band together. The grand design of USPNet was indicated, including ①that the equipment to be procured at hub stations will be for Ku-band, ②plan for replacement from existing equipment of C-band into that of Ku-band, and ③ conception on duplication of hub stations. However JICA Project team did not obtain an agreement of VC at this stage.

2) Request from USP (6th December, 2017)

During hearing from ITS group, it became clear that explanation of the technical specifications of the Equipment to be procured in the Project had not been made by the ITS group to VC, the person responsible at USP. In addition, the ITS group requested preparation of a draft of the technical specifications of the Equipment, with particular focus on the details of the frequency bandwidth, from JICA Project Team, because it was necessary for USP to go through a process of suggesting multiple proposals to VC, who is the final decision maker, and asking for opinions.

3) Explanation by JICA Project Team to USP of the Technical Specifications of the Equipment (7th December, 2017)

JICA Project Team gave explanations in multiple drafts of the technical specifications of the New

Hub Station (Appendix-9), including explanations on the frequency bandwidth, to the Head of the Science and Technology Department and the ITS Group, because VC was absent due to a business trip. As shown in Table-5, in case communication satellites of USPNet consist of only those for Ku-band, there will be merits such as fewer costs compared with the current system, expansion of frequency bandwidth available for communication, reduction of size of antennas at remote stations, longer life expectancy of communication satellites and the like. JICA Project Team explained those merits at the meeting with the Fijian side, and got the understanding of attendees.

Table-5 Comparison between the case of using Ku-band / C-band together and the case using only Ku-band

<table>
<tr><th>Compared points</th><th colspan="2">Using C-band and Ku-band together (same as current operation)</th><th>Using only Ku-band</th><th>Remark</th></tr>
<tr><td>Number of satellite in usage</td><td colspan="2">2</td><td>1</td><td></td></tr>
<tr><td rowspan="3">Satellite communication fee per year</td><td>C-band</td><td rowspan="2">This part is closed due to confidentiality</td><td rowspan="3">1,512,000 FJD
(- 213,800 FJD)</td><td rowspan="3">It is expected that the communication fee of approximately 11.4 million yen (213,800 FJD, 1FJD = 53.29 yen) will be reduced. In addition, maintenance and management fee on regular inspection, equipment for painting and the like will be cut, because the number of satellites will be reduced from 2 to 1.</td></tr>
<tr><td>Ku-band</td></tr>
<tr><td>Total</td><td>1,725,800 FJD</td></tr>
<tr><td rowspan="2">Frequency bandwidth</td><td>C-band</td><td>15 MHz</td><td rowspan="2">20 MHz</td><td rowspan="2">As shown in No. 1 of Table-4, frequency bandwidth can be used effectively in case of adopting only Ku-band. It will be possible to introduce video contents which require high-speed data communication.</td></tr>
<tr><td>Ku-band</td><td>5 MHz</td></tr>
<tr><td rowspan="2">Link availability (Rate of period per year keeping provision of service)</td><td>C-band</td><td>99.98 % - 99.99 %</td><td rowspan="2">99.72 - 99.97 %</td><td rowspan="2">Performance of Ku-band was supposed to be worse in stormy conditions, however it is possible to secure the same availability as the C-band by increasing the power of radio waves from the satellite, increasing the aperture of the antenna at the hub station (from 4.5 m to 7 m class), and so on.</td></tr>
<tr><td>Ku-band</td><td>73.39 % - 99.74 %</td></tr>
<tr><td rowspan="2">Diameter of antennas at remote stations</td><td>C-band</td><td rowspan="2">4.5 m (campuses) - 1.8 m (centres)</td><td rowspan="2">4.5 m (campuses) - 1.8 m (centres) - 1.0 m (housing)</td><td rowspan="2">It will become easier to promote for reduction of difference in education quality in the Pacific region, along with the intention of ITS group, as shown in No. 1 of Table-4</td></tr>
<tr><td>Ku-band</td></tr>
<tr><td rowspan="2">Satellite in usage</td><td>C-band</td><td>NSS-9 and JCSAT-2B (C)</td><td rowspan="2">JCSAT-2B (Ku)
IS-18</td><td rowspan="2">Estimated year that operation of communication satellites will stop are as follows. (Life expectancy of satellites is generally 15 years)
NSS-9: 2024
IS-18: 2026
JCSAT-2B: 2031</td></tr>
<tr><td>Ku-band</td><td>IS-18 and JCSAT-2B (Ku)</td></tr>
</table>

(3) Situation after the 2nd Field Survey

1) Inquiry from USP to JICA Project Team about the Technical Specifications (20th December, 2017)

JICA Project Team received an inquiry via e-mail from USP which said, “After the equipment of Ku-band is introduced at hub stations, will it be possible to replace them with those of C-band?” JICA Project Team answered, “That kind of refurbishment will not be practical from the aspect of its cost, even though it is theoretically possible”.

2) Discussion between USP and JICA Fiji Office (5th January, 2018)

Regarding the Equipment to be procured in the Project, USP showed their intention to select the C-band on the basis of the result of consideration in the university. The background of selecting C-band were stated; ①as a rule of thumb, there remains concern about whether Ku-band will enable the system to operate stably under bad weather condition, ②there will be more alternatives in C-band because multiple communication satellites are currently available, ③update of antennas for C-band at remote stations (campuses) are already being proceeded with the assistance of the Government of New Zealand, etc.

In addition, USP also showed their idea to have discussions with telecommunication providers (Telecom Fiji, Telecom Vanuatu and the like), aiming at ensuring redundancy of USPNet using optical submarine cables as well as communication satellites.

3) Additional Information on USPNet (13th February, 2018)

USP submitted JICA the revised minutes of meeting mentioned in 2). As of this timing, JICA Project Team newly recognized the situation on the Fijian side; update of antennas for C-band, discussions between USP and the telecommunication providers and the like, as stated in 2).

4) Consideration in JICA (20th March, 2018)

JICA examined the sequence of the events through the Project from the 1st field survey for outline design (OD) to the latest, and confirmed again that the specification of the system suggested by JICA Project Team is rational, as shown in Table-5.

5) Implication for Suspension of the Project from the Fijian side (20th March, 2018)

At the interview of USP and JICA Fiji Office, USP told that it was necessary to consider the future way of USPNet including the use of not only communication satellite network but also optical submarine cables, which are proceeded to be under installation recently in the Pacific Island countries, therefore USP was considering the possibility of suspension of the Project.

6) Response of the Japanese Side on the Basis of the Background up to the Present (27th March, 2018 to 26th April, 2018)

i. After the result of 5), on the basis of the background up to the present, the Ministry of Foreign Affairs of Japan and JICA held a meeting to consider the policy for dealing with the Project. It was judged that continuing cooperation for C-band would be difficult due to the following reasons. (27th March, 2018).

- It is scheduled to repair the existing C-band antenna in Laucala campus with the assistance of the Government of New Zealand. Installation of C-band antenna with the assistance of Japan will be

duplication with that of New Zealand and thus excessive investment.

- Functions of C-band to be improved are less compared with those of Ku-band, and thus effectiveness on development is expected to be low.
- Cost for the survey on introducing Ku-band has already been spent so far, therefore it will be a considerable additional cost by changing from Ku-band to C-band.

ii. JICA headquarters explained the policy to suspend the field survey in the Project to the Ministry of Foreign Affairs of Japan and they accepted it. (19th April, 2018)

iii. An official letter regarding the suspension of the Project was issued from JICA headquarters to USP. (19th April, 2018)

iv. JICA Fiji Office visited USP and explained the reason why the field survey of the Project was suspended after handling the letter as a result of discussion between the Ministry of Foreign Affairs of Japan and JICA headquarters. USP acknowledged this and expressed that USP would like to continue positive discussions toward building a new cooperative relationship in the future. (26th April, 2018)

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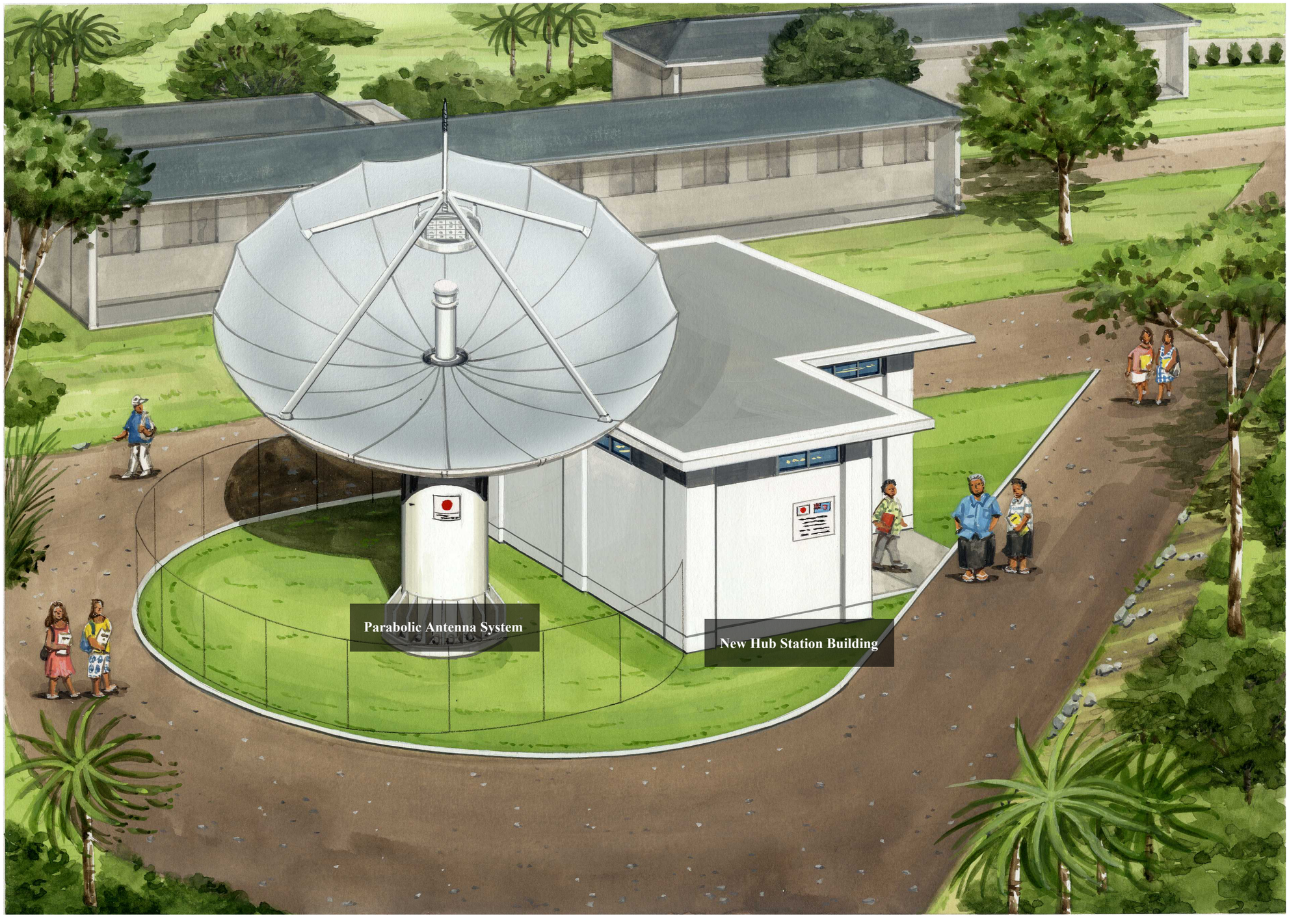
South Pacific

The Republic of Fiji

The University of the South Pacific in Suva

Location Map



The Project for Enhancement of USPNet Communication System
Perspective

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CHAPTER 3 BACKGROUND OF THE SUSPENSION OF THE PROJECT

Abbreviations

A/P	Authorization to Pay
AC	Alternating Current
ACM	Adaptive Coding and Modulation
AUS	Australia
AZ	Azimuth
B/A	Banking Arrangement
BUC	Block Up Converter
DC	Direct Current
DL	Dummy Load
DVB-S2	Digital Video Broadcasting – Satellite – Second Generation
E/N	Exchange of Notes
EIA	Environmental Impact Assessment
EIAJ	Electronic Industries Association of Japan
EL	Elevation
FCC	Federal Communications Commission
FEA	Fiji Electricity Authority
FIRCA	Fiji Revenue and Custom Authority
FJD	Fijian Dollar
FMS	Fiji Meteorological Service
G/A	Grant Agreement
GL	Ground Level
H	Hybrid
ICN1	Interchange Cable Network 1
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
IF	Interface
IP	Internet Protocol
ISO	International Organization for Standardization
ITS	Information Technology Services
ITU	International Telecommunication Union
JCS	Japanese Cable Makers' Association Standard
JEAC	Japan Electric Association Code
JEC	Japanese Electrotechnical Committee
JEM	Japan Electrical Manufacturers’ Association
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
LAN	Local Area Network
NMS	Network Management System

NZ	New Zealand
NZD	New Zealand Dollar
OJT	On the Job Training
POL	Polarization
RX	Receiving
SPT	Standard Penetration Test
TCN	Tonga Cable Network
TDMA	Time Division Multiple Access
TX	Transmitting
UPS	Uninterruptible Power Supply
USD	US Dollar
USP	The University of the South Pacific
USPNet	The University of the South Pacific Network
VAT	Value Added Tax

CHAPTER 1 BACKGROUND OF THE PROJECT

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1-1 Background, Circumstances and Outline of Grant Aid

The “Remote and Islands Area Education Support Program” is a cooperative programme that is part of Japan’s business expansion plan for the Republic of Fiji (hereinafter referred to as “Fiji”) (as of April 2016). It is based on the area of “Sustainable Development (including human resource development)” which was confirmed at the 7th Pacific Islands Leaders Meeting (PALM7) held in May 2015. The “Pacific Leader’s Educational Assistance for Development of State” (hereinafter referred to as “Pacific-LEADS”) is planned as one of the programmes of the Remote and Islands Area Education Support Program. Pacific-LEADS is planned to be implemented in Fiji along with the Remote and Islands Area Education Support Program. In Pacific-LEADS, human resource development is set as an important measure for sustainable economic growth and the improvement of the living standards of the people in the Pacific Island countries. It is considered that providing higher-education services through the distribution of distance learning by the University of the South Pacific (hereinafter referred to as USP), the only higher education institution in the Pacific Island countries, will benefit not only the 12 member countries and regions of USP but all of the Pacific Island countries. However, deterioration of the equipment due to aging for the C-band satellite communication system (hereinafter referred to as “USPNet”) that supports distribution of this distance learning is a major risk for USPNet. USP is worried about interruption of communications that may be caused by deterioration of the equipment due to aging, that is, interruption of distance learning. In response to this issue, in April 2017, the Government of Fiji and the Ministry of Education of Fiji requested Japan a Grant Aid called the Project for Enhancement of USPNet Communication System (hereinafter referred to as “the Project”). The Project consists of the following: ① New Hub Station Building, ② antenna and satellite communication equipment, ③ baseband hub system (made in the United States), ④ facility for power supply and A/C in the New Hub Station Building, and ⑤ updating of USPNet, including soft components. The survey team of the Project (hereinafter referred to as “JICA Project Team”) implemented an on-site survey and confirmed that some pieces of the equipment of the C-band satellite communication system have been in use since 2000. In general, this kind of equipment is considered to have a productive life of 10 to 15 years. There is therefore a possible risk of interruption of communications due to breakdowns of the equipment, as the equipment may have deteriorated due to aging. That is, there is a risk of interruption of distance learning. It is expected that updating all of the equipment of the hub station will ensure the stability and reliability of the satellite communication system. Implementing the Project will benefit approximately 11,300 students (approximately 49% of all students, from 2013 to 2017) using distance learning at campuses and centres in 12 member countries and regions. This is expected to contribute to the human resource development goals declared in PALM7.

In the 1st Field Survey, to prepare the outline design of the Project, JICA Project Team discussed various perspectives on the technical aspect, expense, capacity for maintenance and operations, and the like with

the Fijian side, and an appropriate plan for equipment procurement was established. Table 1-1-1 shows the components of the Project.

Table 1-1-1 Project Components (Draft)

1. Procurement of the Equipment (1) Procurement of the Equipment 1) Parabolic Antenna System 2) Low Noise Converter System 3) Block Up Converter System 4) Baseband System 5) Monitoring and Control System for Hub Station 6) Uninterruptible Power Supply (UPS) 7) Lightning Protection Device 8) Measuring Instrument 9) Spare Parts 10) Consumable Parts (2) Installation works of the Equipment 1) Construction of New Hub Station Building 2) Construction of Parabolic Antenna Foundation 3) Installation of Equipment 4) Adjustment and Testing (3) Initial operation and maintenance training by the Supplier
2. Consulting Services (1) Detailed Design, bidding and supervision (2) Soft Components (Assistance in the start-up or operation and maintenance) 1) Transition into New System / Daily Operation Technology 2) Satellite Communication Link Usage/Application Technology

Source: JICA Project Team

1-2 Natural Conditions

1-2-1 Topography

Fiji is an island nation consisting of about 330 islands located in the South Pacific and to the east of Australia. Fiji has an area of 130,000 km^2 centred on the position of 180°W and 18°S. Most of the area is ocean. The total area of the land portion is 18,270 km^2 (Source: World Bank, 2016). The main island, where the capital city Suva is located, is Viti Levu Island. It has an area of 10,429 km^2. The second largest island is Vanua Levu, with an area of 5,556 km^2. Both islands have mountains of more than 900 m, which affects the climate in Fiji. People live on about 100 of the islands of Fiji.

1-2-2 Climate

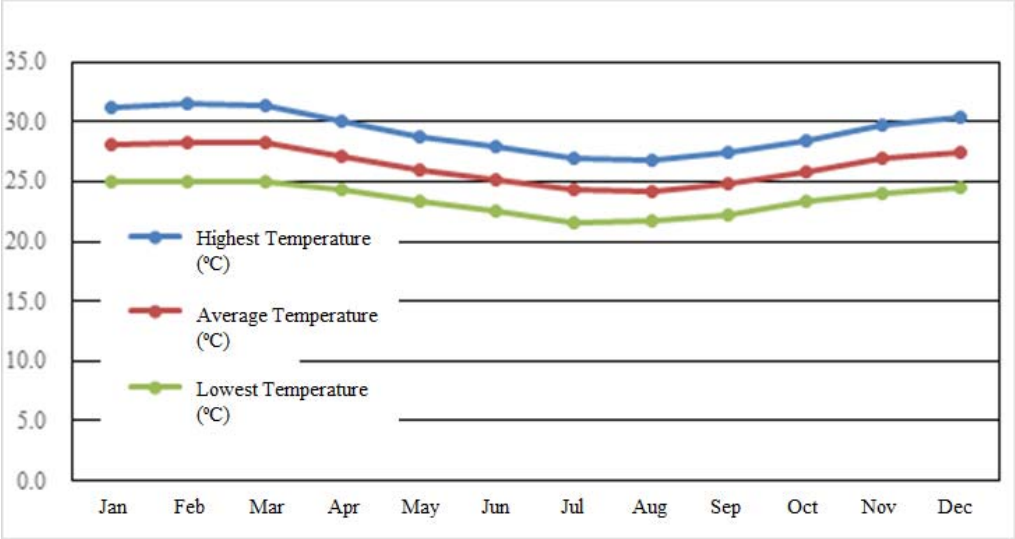
Fiji has a maritime tropical climate. In Viti Levu Island, which is the targeted site of the Project, trade winds always blow from the southeast. The winds are not particularly violent, except during the cyclone season, from November to April. The maximum recorded instantaneous wind speed was 85 m/s on Vanua Balavu Island, which is located approximately 300 km east from Suva, during the cyclone Winston in February 2016.

According to a report covering the years 2011-2016 from the Fiji Meteorological Service (hereinafter referred to as "FMS"), the temperature in Suva is nearly constant. The maximum temperature in the target area (Suva) was 32.7 °C and the minimum temperature was 20.3 °C. Table 1-2-1 shows the information on temperature and humidity in Suva obtained from FMS, and Figure 1-2-1 shows the monthly average of highest, average and lowest temperature in Suva.

Table 1-2-1 Temperature and humidity (2011-2016)

Category	Minimum	Maximum	Average
Temperature (°C)	21.6-25.1	26.7-31.5	24.2-28.2
Humidity (%)	55.5-63.2	96.2-98.2	75.9-79.2

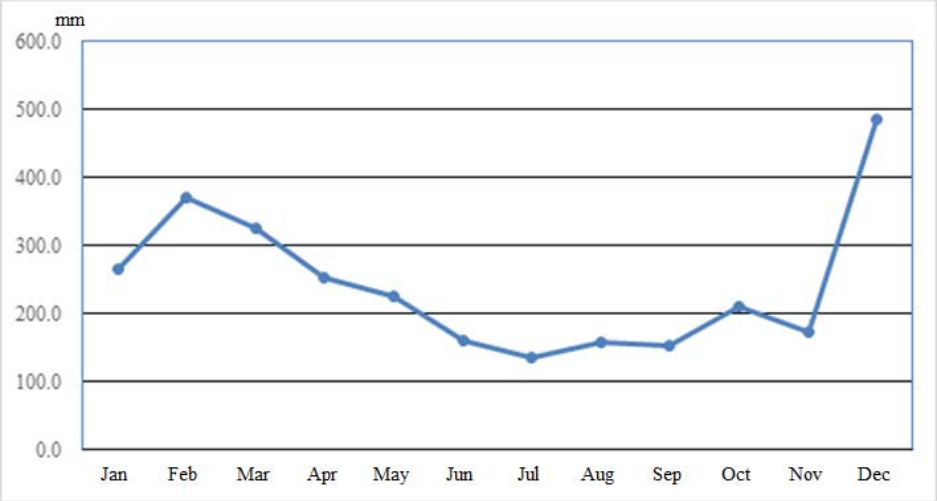
Source: FMS



Source: FMS

Figure 1-2-1 Monthly average of highest, average and lowest temperature in Suva (2011–2016)

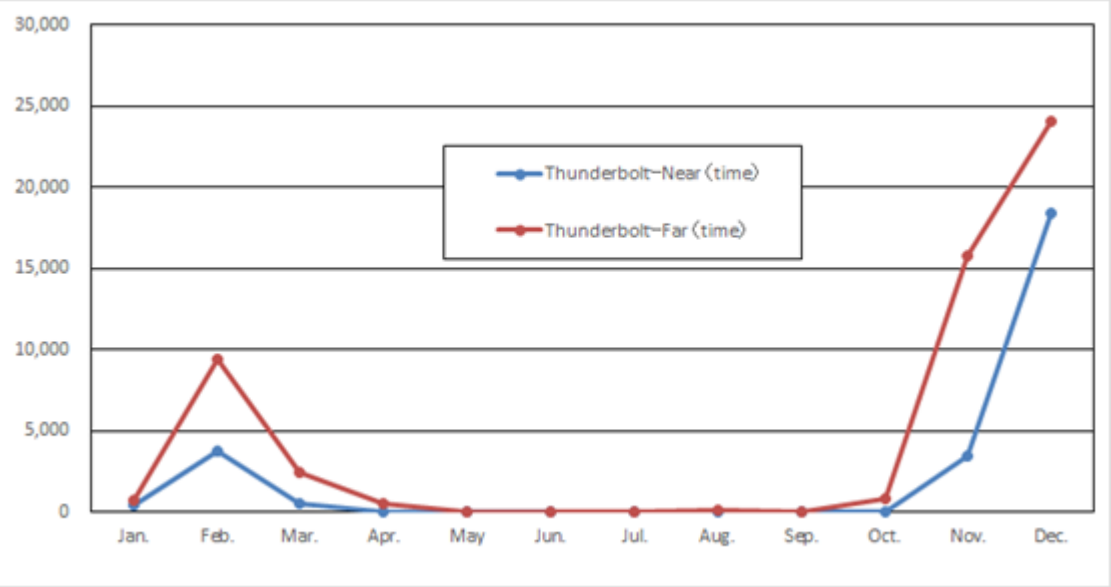
The average monthly rainfall in Suva is large in December. The number of days with precipitation is about 20 per month and the average annual rainfall is 2,915 mm. Figure 1-2-2 shows the monthly average of rainfall in Suva.



Source: FMS

Figure 1-2-2 Monthly average of rainfall in Suva (2011–2016)

The 2016 FMS report shows the number of lightning strikes, which reached a peak of 42,426 in December. Figure 1-2-3 shows the number of lightning strikes in Suva and its neighboring regions.



Source: FMS

Figure 1-2-3 Number of lightning strikes by month in 2016 in Suva and neighboring regions

1-2-3 Skyline Measurement[1]

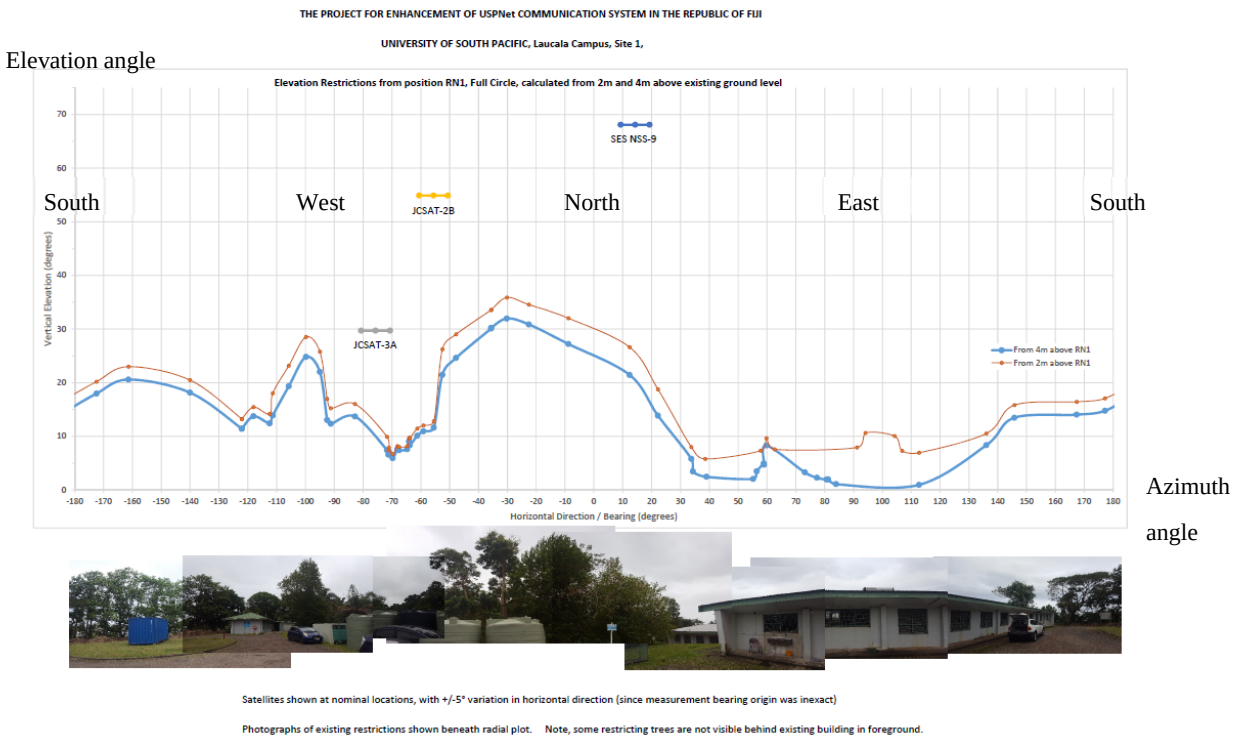
JICA Project Team implemented skyline measurement of JCSAT-2B, NSS-9, which is currently used in the C-band, and JCSAT-3A, which is the backup satellite for JCSAT-2B. These communication satellites are considered to be usable from the site for installation of a new parabolic antenna in the Project. It was confirmed that there is no topography and are no structures that would interfere with the communication satellites.

Table 1-2-2 shows the positions of the communication satellites which are currently being used for USPNet and which will be used in the Project. Figure 1-2-4 shows the results of skyline measurement. For reference, the satellite currently being used in the Ku-band, IS-18, is not mentioned in the results because it is located in a stationary orbit 36,000 km above the position of 180°E and the equator, which is almost the same as that of NSS-9 (36,000 km above the position of 177°W and the equator, which is distant from IS-18 by only 3°). The elevation angle of NSS-9 is 68.1° and its azimuth angle is 14.3° from north to east.

Table 1-2-2 Positions of communication satellites

Satellite	NSS-9	IS-18	JCSAT-2B	JCSAT-3A
Orbit	177°W	180°E	154°E	128°E
Altitude	36,000 km above the equator			
Bandwidth	C-band (operating)	Ku-band (operating)	Ku-band (intended to be used)	Ku-band (intended to be used)

[1] Measurements at the highest point of the horizon and of structures and trees and the like 360° around the antenna installation position. The measurement result is used for judging the existence of topography or structures that may interfere with the communication satellite, and the existence of trees or the like that may become a hindrance in the future.



Elevation angle

South West North East South

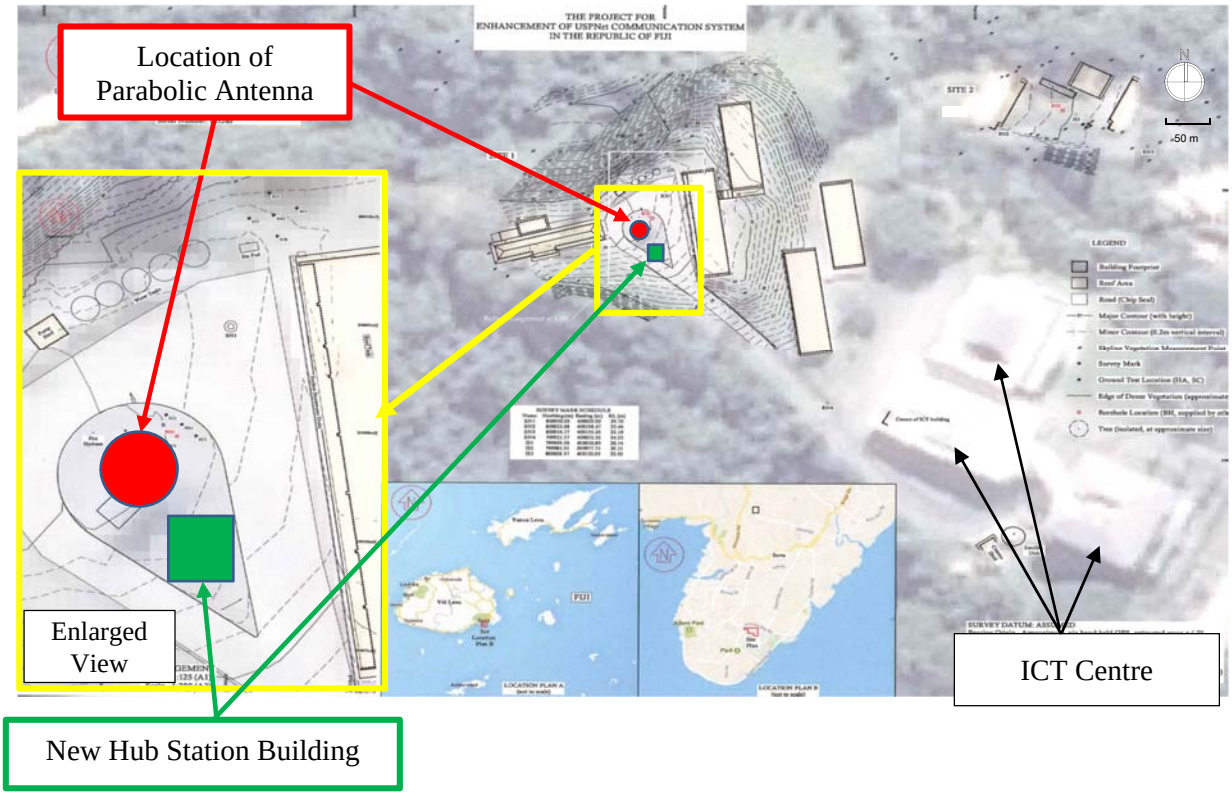
Azimuth angle

Source: JICA Project Team

Figure 1-2-4 Result of skyline measurement

1-2-4 Site Topographical Survey

A topographical survey around the site where the New Hub Station Building will be constructed and the parabolic antenna will be installed was carried out. Since the site is located on a hill and only one-storey office buildings and a one-storey dormitory are nearby, there will be no disturbance of satellite communication system from the parabolic antenna due to tree growth. A detailed topographical plan of the site is shown in Figure 1-2-5.

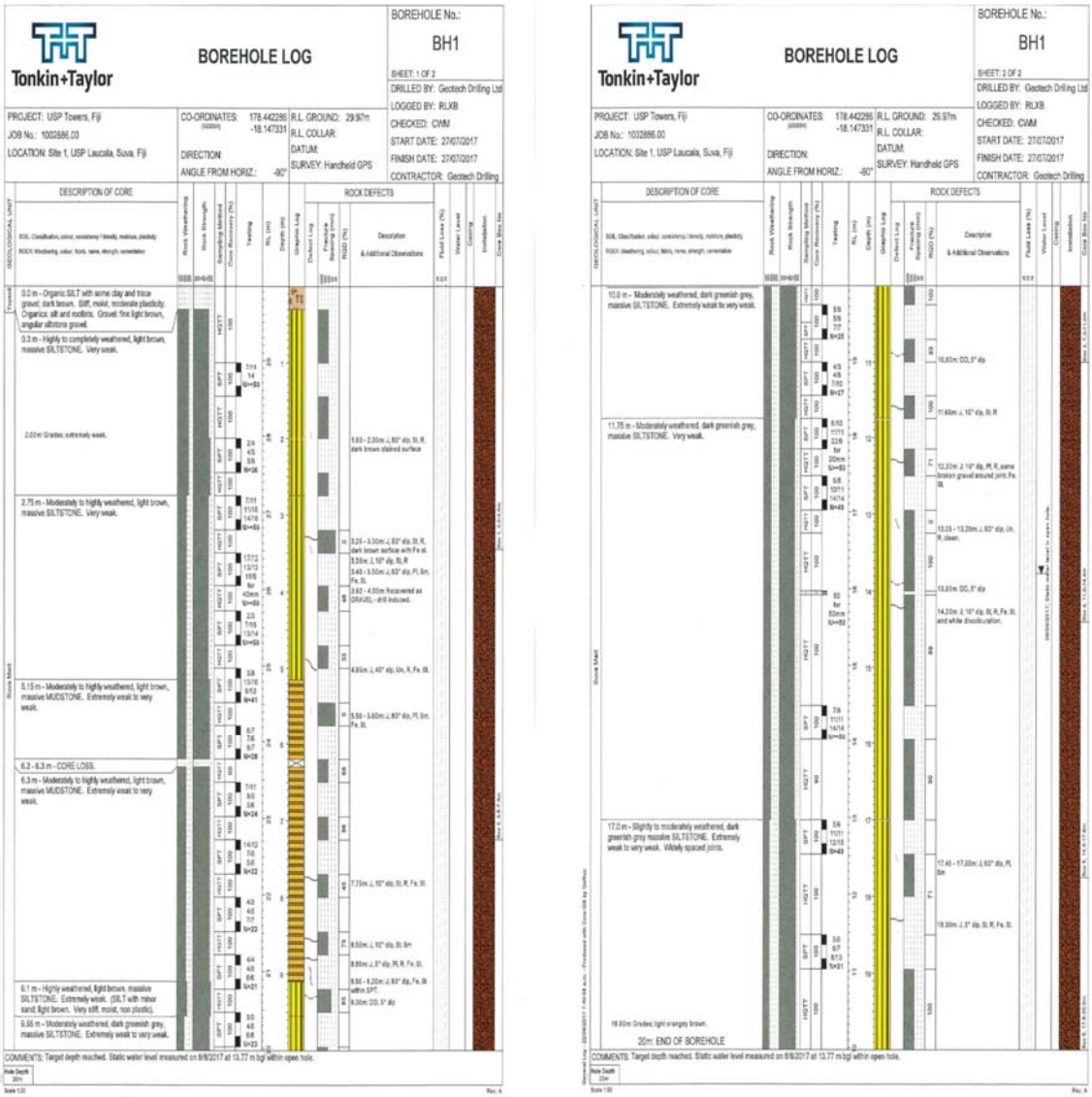


Source: JICA Project Team (Locations of New Hub Station Building, Parabolic Antenna and ICT Centre are additionally noted on the survey map.)

Figure 1-2-5 Site Topographical Plan

1-2-5 Borehole Drilling Survey (Standard Penetration Test)

JICA Project Team has conducted a standard penetration test (hereinafter referred to as "SPT") as a borehole drilling survey at the two (2) respective sites where New Hub Station Building will be constructed and the parabolic antenna will be installed. Figure 1-2-6 shows the results of the borehole drilling survey. According to the results, a silt layer with SPT N-values of 50 or more was observed at 1 m depth from the ground. This layer supports ground with a long-term permissible bearing capacity of 300 kN/m^2 or more.



Source: JICA Project Team

Figure 1-2-6 Borehole Drilling Survey

1-3 Environmental and Social Considerations

The New Hub Station of USPNet will be built at the Laucala campus by the Project, and the major structures are the New Hub Station Building (7 x 9 m) and the parabolic antenna (Diameter: 7 m). The topographical survey confirmed that cutting down trees at the site will not be necessary. It was also confirmed through discussions between the USP and JICA Project Team that it will not be necessary to relocate or demolish any of the existing buildings to implement the installation work for the equipment. In the future, the USP executive board will deliberate on the installation position of the New Hub Station Building and the parabolic antenna and officially set the installation position. After that, USP will undertake compliance with Fijian laws and procedures and ensure that all procedures are completed by the commencement of the installation work. As mentioned above, there will be almost no impact on the natural environment because cutting down trees will not be necessary. The impact on the living environment will also be minimal because it will not be necessary to relocate any existing buildings and there is no housing around the Project site.

CHAPTER 2 CONTENTS OF THE PROJECT

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

2-1-1 Overall Goal and Project Objectives

More than 15 years have passed since the commencement of USPNet operation and its equipment have become aging and have troubles. While the number of students of USP tends to increase, quality of video image and sound of satellite communication system are becoming lower due to limitation of transmission speed and capacity of USPNet. Therefore, there is currently a need to update the satellite communication system. On the basis of these facts, the Government of Fiji requested assistance from the Government of Japan for Grant Aid for the Project. The overall goal of the Project is "to provide the distance learning services for higher education to other USP member countries and regions and to provide support in their maintenance and management". In addition, the objective of the Project is "to revitalize and improve the functioning of the distance learning networks".

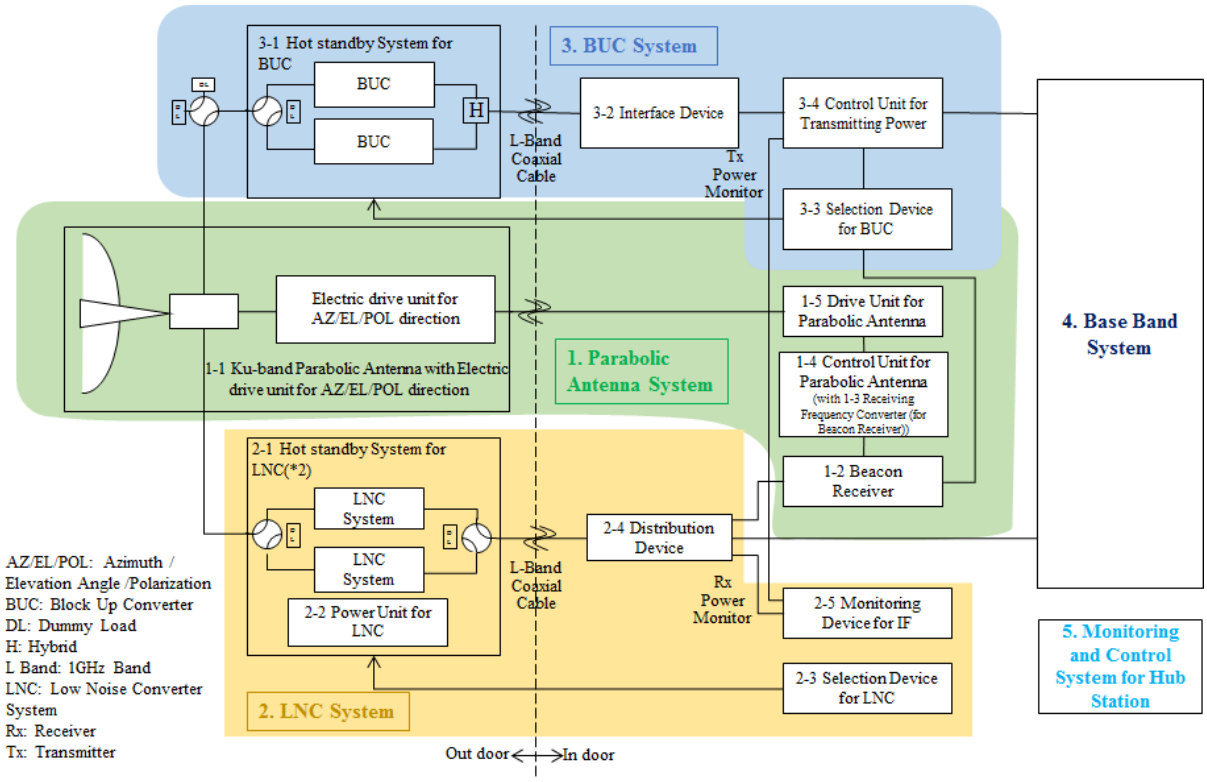
2-1-2 Outline of the Project

USP is currently operating USPNet using two kinds of satellite communications, C-band and Ku-band, together. Equipment of the satellite communication network using C-band is planned to be upgraded to solve its defects. Meanwhile, the Project aims at unifying the satellite communication system into the Ku-band along with the timing of C-band update. Unifying the system into the Ku-band will be cost effective; for example, maintenance expenses will decrease. On the other hand, remote stations of USPNet are scheduled to be improved and updated with the assistance of the fund from the Government of New Zealand. JICA Project Team suggests smoothly unifying the system into Ku-band in conformity to the improvement and update of remote stations, by sharing information about equipment specification at hub stations to related agencies. Furthermore, in order to achieve the overall goal of the Project, JICA Project Team will make a plan for improving redundancy of USPNet for continuing distance learning service stably. Table 2-1-1 shows components of the Project and Figure 2-1-1 shows configurations of the equipment to be procured in the Project.

Table 2-1-1 Project Component (draft)

1. Equipment (1) Procurement 1) Parabolic Antenna System 2) Low Noise Converter System 3) Block Up Converter System 4) Baseband System 5) Monitoring and Control System for Hub Station 6) Uninterruptible Power Supply (UPS) 7) Lightning Protection Device 8) Measuring Instrument 9) Spare Parts 10) Consumable Parts (2) Construction and Installation 1) Construction of Building for New Hub Station (hereinafter referred to as "New Hub Station Building") 2) Construction of Parabolic Antenna foundation 3) Installation of Equipment 4) Adjustment and Testing (3) Initial Guidance and Operating Guidance
2. Consulting Services (1) Detailed Design, Support of Tender and Supervision on site (2) Soft Components 1) Transition into New System / Daily Operation Technology 2) Satellite Communication Link Usage/Application Technology

Source: JICA Project Team



Numbers in the figure correspond to those in Table 2-2-6.
Source: JICA Project Team

Figure 2-1-1 Configuration Diagram of the Equipment to be Procured in the Project

2-2 Outline Design of the requested Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

At USP that has many campuses and centres in the Pacific Island countries, USPNet is an indispensable tool for distributing distance learning service for higher education. USP greatly contributes to broaden the opportunities for higher education using distance learning service, which has a significant effect in improving the level of education within the region. In addition, USP has a database system for recording all lectures and distributes those lectures through unicast[2] communication in accordance with requests from students. The basic policy in the Project is to aim for the stable operation of USPNet, which serves as the communication platform supporting distance learning delivered to remote stations (campuses / centres). The respective design policies are indicated below.

[2] Unicast is one of communication means which distributes data to a single destination.

(2) Policy on USPNet Satellite Communication Lines

The satellite communication lines currently used by USPNet consists of 15MHz bandwidth of European communication satellite NSS-9 C-band and 5MHz bandwidth of US communication satellite IS-18 Ku-band, for a total of 20MHz bandwidth. Because two (2) systems of satellite communication lines are currently used and equipment for each form of satellite communication are held, there are duplication of expenses for maintenance and management of the system, including satellite usage and electricity. In addition, it has become necessary for USP to accelerate satellite communication lines to diversify educational services in response to an increase of students. However, the speed of the communication lines has not become faster and their capacities have not become larger, because the bandwidth ensured by current contract for satellite communication cannot be expanded due to financial restrictions. The Project will consolidate the communication satellites used by USPNet into Ku-band in an effort to reduce maintenance and management costs, including expense of satellite communication line usage and will make a plan for achieving system capable of supporting communication with higher speeds. Note that there is a demerit in Ku-band that its attenuation in case of rain is larger due to its short wavelength than that of C-band. However, according to a study conducted by JICA Project Team on the link availability[3] at remote stations, it was confirmed that an operating rate of at least 99.65 % can be secured for all remote stations under the condition that the output from the transponder of satellite communication is at least 150W.

As the contract for the satellite communication line of the Project is the responsibility of the Fijian side, it is necessary for USP to enter into a contract for use of the new Ku-band bandwidth of 20MHz and a line with a satellite transmission output of 150 W or more. In addition, it is necessary to change the existing C-band equipment at remote stations into the Ku-band in accompaniment with the changes in the USP contract. Table 2-2-1 shows the outbound link availability of Ku-band Hub Station System (Hub Station ⇒ Remote Station) and Table 2-2-2 shows the inbound link availability of Ku-band Hub Station System (Remote Station ⇒ Hub Station).

[3] The link availability is a rate that expresses the percentage (%) of time that the system was actually functioning out of the total time that the system should have been available for use, excluding periods of time in which the system was not available due to factors such as system suspension due to unstable radio waves resulting from rain, etc. This system suspension time also excludes periods of suspension due to equipment breakdowns and equipment checks, etc.

Table 2-2-1 Outbound Link Availability of Ku-band Hub Station System (Hub Station ⇒ Remote Station)

Earth Station																										
Uplink Site	Country	Fiji																								
	City	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala
Antenna Diameter	m	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Downlink Site	Country	Fiji	Samoa			Vanuatu					Cook Is.	Kiribati	Niue	Tonga			Marshall Is.	Solomon Is.		Tuvalu	Nauru	Tokelau				
	City	Lambasa	Alafua	Alafua	Savai'i	Emalus	Santo	Tafea	Malampa	Torba	Cook Is.	Kiribati	Niue	Tonga	Ha'apai	Vava'u	Marshall Is.	Solomon Is.	Lata	Tuvalu	Nauru	Tokelau	Fakaofo	Nukunonu		
Antenna Diameter	m	1.8	6.3	1.8	1.8	4.5	3.8	1.8	1.8	1.8	4.5	4.5	4.5	4.5	1.8	1.8	4.5	4.5	1.8	4.5	4.5	4.5	4.5	4.5		
TPC	dB	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10		
Carrier Information																										
Information Rate	Mbps	5,000	17,190	5,000	5,000	17,190	17,190	5,000	5,000	5,000	17,190	17,190	17,190	17,190	5,000	5,000	17,190	17,190	5,000	17,190	17,190	17,190	17,190	17,190		
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK		
FEC Type		DVB-S2	LDPC	DVB-S2	DVB-S2	LDPC	LDPC	DVB-S2	DVB-S2	DVB-S2	LDPC	LDPC	LDPC	LDPC	DVB-S2	DVB-S2	LDPC	LDPC	DVB-S2	LDPC	LDPC	LDPC	LDPC	LDPC		
FEC Rate		3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4		
Symbol Rate	Msps	3.597	12.367	3.597	3.597	12.367	12.367	3.597	3.597	3.597	12.367	12.367	12.367	12.367	3.597	3.597	12.367	12.367	3.597	12.367	12.367	12.367	12.367	12.367		
Allocated BW	MHz	4.320	14.850	4.320	4.320	14.850	14.850	4.320	4.320	4.320	14.850	14.850	14.850	14.850	4.320	4.320	14.850	14.850	4.320	14.850	14.850	14.850	14.850	14.850		
Power Equivalent BW	MHz	–	14.840	–	–	14.840	14.840	–	–	–	14.840	14.840	14.840	14.840	–	–	14.840	14.840	–	14.840	14.840	14.840	14.840	14.840		
Link Budget (Total)																										
C/N total (Thermal)	dB	10.3	14.5	11.1	11.1	13.7	13.6	10.2	11.1	11.4	13.0	13.5	13.9	13.3	10.5	10.9	13.7	13.9	10.3	13.4	14.0	13.2	13.4	13.3		
C/I	dB	12.2	12.8	12.2	12.2	12.8	12.7	12.2	12.2	12.2	12.8	12.8	12.8	12.8	12.2	12.2	12.8	12.8	12.2	12.8	12.8	12.8	12.8	12.8		
Total C/(N+1)	dB	8.1	10.6	8.6	8.6	10.2	10.1	8.1	8.6	8.8	9.9	10.1	10.3	10.0	8.2	8.5	10.2	10.3	8.1	10.1	10.3	10.0	10.0	10.0		
Required C/(N+1) *1	dB	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3		
Total C/(N+1) Margin	dB	3.8	6.2	4.3	4.3	5.9	5.8	3.7	4.2	4.5	5.5	5.8	5.9	5.7	3.9	4.1	5.9	6.0	3.8	5.7	6.0	5.6	5.7	5.7		
Link Availability *2	%	99.76	99.97	99.81	99.81	99.97	99.96	99.82	99.84	99.85	99.94	99.95	99.96	99.96	99.83	99.84	99.95	99.95	99.72	99.95	99.96	99.94	99.94	99.94		

【Note】 *1: Since the link availability is calculated based on the current performance of JCSAT-2B and the gain of the transponder, it may change depending on the performance of the satellite and the gain of the transponder.

*2: These parameters are based on Guaranteed Eb/No of iDirect satellite modem.

*3: These parameters are based on ITU-R P.618-12 and its related documents.

Source: JICA Project Team

Table 2-2-2 Inbound Link Availability of Ku-band Hub Station System (Remote Station ⇒ Hub Station)

Earth Station																										
Uplink Site		Fiji	Samoa			Vanuatu					Cook Is.	Kiribati	Niue	Tonga			Marshall Is.	Solomon Is.		Tuvalu	Nauru	Tokelau				
		Lambasa	Alafua	Alafua	Savai'i	Emalus	Santo	Tafea	Malampa	Torba	Cook Is.	Kiribati	Niue	Tonga	Ha'apai	Vava'u	Marshall Is.	Solomon Is.	Lata	Tuvalu	Nauru	Tokelau	Fakaofo	Nukunonu		
Antenna Diameter	m	1.8	6.3	1.8	1.8	4.5	3.8	1.8	1.8	1.8	4.5	4.5	4.5	4.5	1.8	1.8	4.5	4.5	1.8	4.5	4.5	4.5	4.5	4.5		
Downlink Site		Fiji																								
		Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala	Laucala		
Antenna Diameter	m	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		
TPC	dB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Carrier Information																										
Information Rate	Mbps	0.512	2.250	0.512	0.512	2.250	2.250	0.512	0.512	0.512	2.250	2.250	2.250	2.250	0.512	0.512	2.250	2.250	0.512	2.250	2.250	2.250	2.250	2.250		
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK		
FEC Type		2D16S-438B	2D16S-170B	2D16S-438B	2D16S-438B	2D16S-170B	2D16S-170B	2D16S-438B	2D16S-438B	2D16S-438B	2D16S-170B	2D16S-170B	2D16S-170B	2D16S-170B	2D16S-438B	2D16S-438B	2D16S-170B	2D16S-170B	2D16S-438B	2D16S-170B	2D16S-170B	2D16S-170B	2D16S-170B	2D16S-170B		
FEC Rate		2/3	1/2	2/3	2/3	1/2	1/2	2/3	2/3	2/3	1/2	1/2	1/2	1/2	2/3	2/3	1/2	1/2	2/3	1/2	1/2	1/2	1/2	1/2		
Symbol Rate	Msps	0.388	2.500	0.388	0.388	2.500	2.500	0.388	0.388	0.388	2.500	2.500	2.500	2.500	0.388	0.388	2.500	2.500	0.388	2.500	2.500	2.500	2.500	2.500		
Allocated BW	MHz	0.470	3.000	0.470	0.470	3.000	3.000	0.470	0.470	0.470	3.000	3.000	3.000	3.000	0.470	0.470	3.000	3.000	0.470	3.000	3.000	3.000	3.000	3.000		
Power Equivalent BW	MHz	–	3.000	–	–	3.000	3.000	–	–	–	3.000	3.000	3.000	3.000	–	–	3.000	3.000	–	3.000	3.000	3.000	3.000	3.000		
Link Budget (Total)																										
C/N total (Thermal)	dB	14.4	14.4	14.4	14.4	14.4	14.4	12.9	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4		
C/I	dB	12.8	12.8	12.8	12.8	12.8	12.8	11.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8		
Total C/(N+1)	dB	10.5	10.5	10.5	10.5	10.5	10.5	9.3	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5		
Required C/(N+1) *1	dB	4.0	2.2	4.0	4.0	2.2	2.2	4.0	4.0	4.0	2.2	2.2	2.2	2.2	4.0	4.0	2.2	2.2	4.0	2.2	2.2	2.2	2.2	2.2		
Total C/(N+1) Margin	dB	6.5	8.3	6.5	6.5	8.3	8.3	5.3	6.5	6.5	8.3	8.3	8.3	8.3	6.5	6.5	8.3	8.3	6.5	8.3	8.3	8.3	8.3	8.3		
Link Availability *2	%	99.82	99.88	99.80	99.80	99.91	99.89	99.81	99.82	99.79	99.88	99.84	99.89	99.92	99.86	99.84	99.84	99.85	99.78	99.86	99.83	99.86	99.86	99.85		

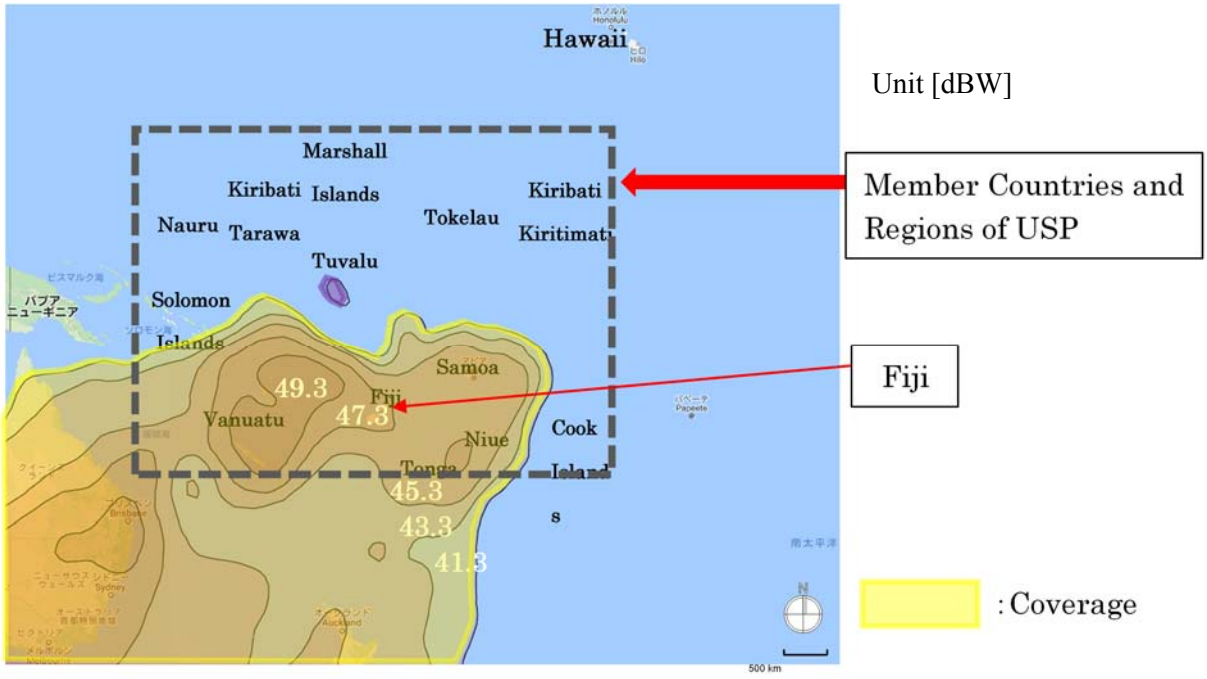
【Note】 *1: Since the link availability is calculated based on the current performance of JCSAT-2B and the gain of the transponder, it may change depending on the performance of the satellite and the gain of the transponder.

*2: These parameters are based on Guaranteed Eb/No of iDirect satellite modem.

*3: These parameters are based on ITU-R P.618-12 and its related documents.

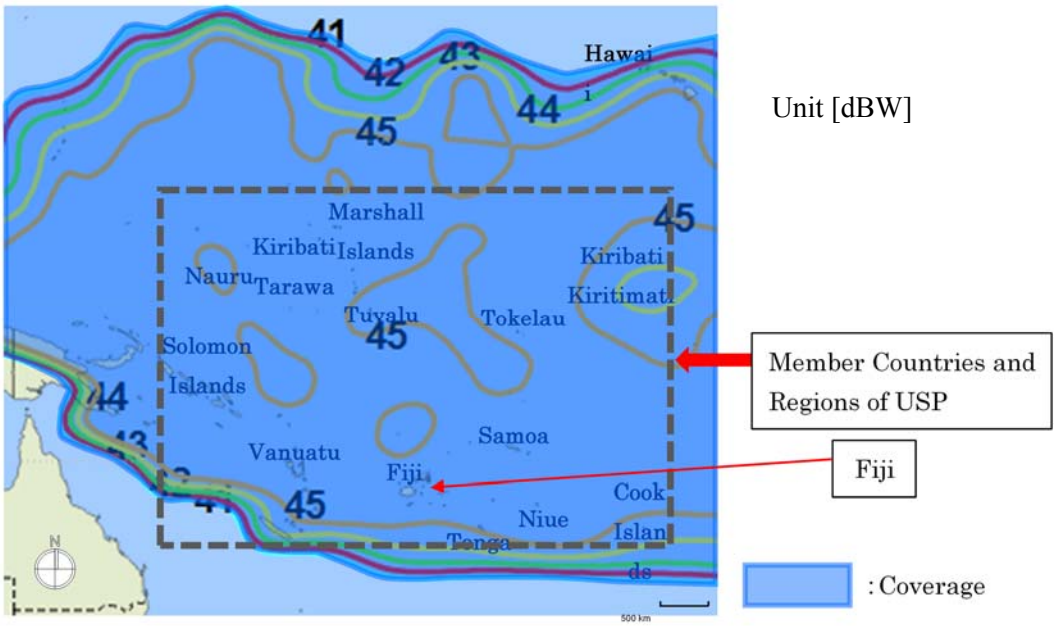
Source: JICA Project Team

Figure 2-2-1 shows the coverage area of the communication satellite Intelsat IS-18, which is used in Ku-band satellite communication network. In the case of IS-18, some of the member countries and regions, such as Nauru, Kiribati, Marshall Islands, Tuvalu, Tokelau, Cook Islands, are not included in the coverage area. In addition, Figure 2-2-2 shows the coverage area of the communication satellite JCSAT-2B as an example of a communication satellite that supports the Ku-band at a transmission output of 150W. This communication satellite covers the Pacific Island countries which makes it possible for all remote stations in the USP member countries and regions to be connected to USPNet. JCSAT-2B can ensure higher link availability than IS-18 because its signal electric field is stronger in the coverage area.



Source: South Pacific Beam Footprint

Figure 2-2-1 Coverage Area of the Communication Satellite Intelsat IS-18



Source: Homepage of SKY Perfect JSAT. http://www.jsat.net

Figure 2-2-2 Coverage Area of the Communication Satellite JCSAT-2B

(3) Policy on USPNet Redundancy

1) Active and backup (duplex) structure

In order to improve the redundancy of USPNet and provide highly reliable educational services, a redundant structure[4] shall be adopted using some of the procured active and backup equipment. The structure shall be designed to automatically switch the communication system when there is an unexpected breakdown (hot standby). In addition, the structure shall enable stable operation of USPNet by making spare parts available (cold standby) separately so that malfunctioning or failing parts can be promptly replaced.

2) Hub station duplex structure (Site redundancy)

The Hub Station located at the Laucala campus in Fiji has a role of providing services to remote stations located in a broad section of the South Pacific region via communication satellites, and serves as a central hub for USPNet. There are plans to construct a new Hub Station (hereinafter referred to as "secondary Hub Station") at a campus other than the Laucala campus to improve the redundancy against disasters such as cyclones and increase the stability of operation of USPNet. The secondary Hub Station will act as a backup to communication functions of the New Hub Station, and enable the stable provision of distance

[4] The active and backup duplex structure consists of equipment currently in use for operating USPNet and backup equipment that is promptly switched to automatically when there is an unexpected breakdown in the active equipment.

learning by maintaining operations of USPNet even when the New Hub Station malfunctions. In addition, it will be possible for USPNet to operate without suspension by having the secondary Hub Station function on behalf of the New Hub Station during maintenance of the New Hub Station. In the USP plan regarding duplex structure, it is assumed that the secondary Hub Station will be constructed in either ①Tonga, ②Vanuatu, ③Samoa[5] or ④Marshall Islands[6] that are connected or will be connected to Fiji by optical submarine cables. While the construction of the secondary Hub Station is not included in the Project, the design shall enable remote monitoring and control of the secondary Hub Station from the New Hub Station, and connection between the New Hub Station and the secondary Hub Station will be facilitated when the secondary Hub Station is constructed.

A comparative study on the four (4) countries mentioned above as potential construction locations for the secondary Hub Station was conducted from the viewpoints of economics, disaster vulnerability, land acquisition, etc. The comparison results are indicated in Table 2-2-3. On the basis of the comparison results, the campus in Tonga is believed to be most advantageous as a construction location for the secondary Hub Station because it has a direct optical submarine cable connection with the location in Fiji which USPNet is already operating and thus communication costs will be relatively low. When it comes to selection of the secondary Hub Station, note that in facility and equipment designs for this campus it will be necessary to take into consideration on land acquisition, situation of telecommunication, countermeasures against tsunamis and high waters, and other needs from the targeted country. Figure 2-2-3 indicates the USPNet structure after the construction of the secondary Hub Station.

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5 Optical submarine cable between Samoa and Fiji was connected in February 2018. (http://www.samoaobserver.ws/en/10_02_2018/local/29838/Tui-Cable-goes-live.htm)

6 Optical submarine cable between Marshal Islands and Fiji is not directly connected. (connection is via Guam)

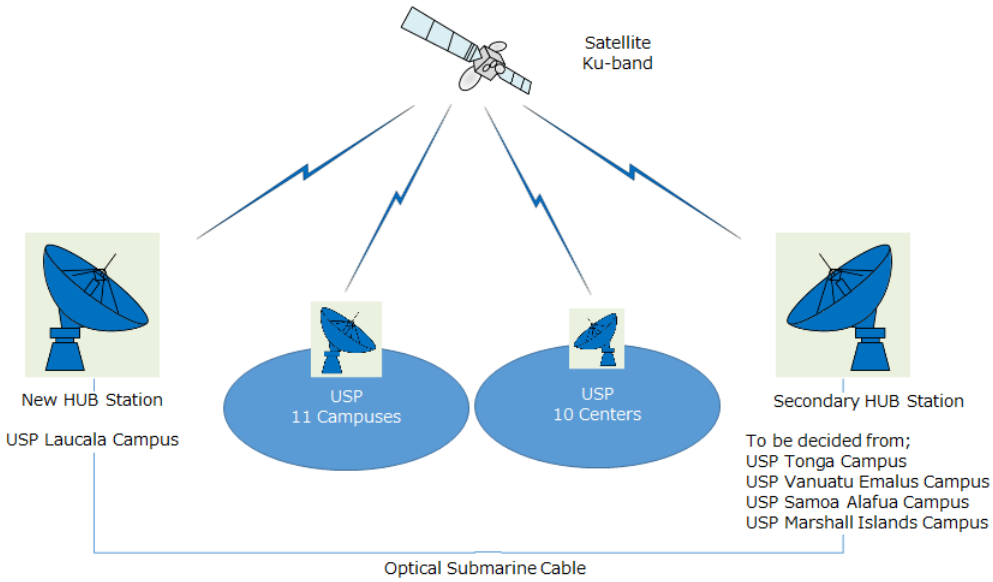
Table 2-2-3 Result of Comparison on Location for Construction of the Secondary Hub Station

Items for comparison / Candidate location	Optical submarine cable			Disaster vulnerability		Land		Study results
	Operating body	Operating Costs	USPNet operation results	Tsunami/high water levels	Earthquakes	Securing	Procedures	
Tonga	Government-affiliated: TCN	○ Low	○[7] In operation for 4 years	△ Will have an impact (Low elevation)	△ High frequency	○ Easy	○ Relatively easy	○
Vanuatu	Private sector company: ICN1	△ High	-	○ No impact	△ High frequency	○ Easy	△ Difficult	△
Samoa	Government-affiliated: Tui-Samoa	-	-	○ No impact	△ High frequency	○ Easy	△ Difficult	△
Marshall Islands	Government-affiliated: HANTRU1	○ Low	△Unstable; communication disruption is common	△ Will have an impact (Low elevation)	◯ Low frequency	△ Difficult (narrow building site)	△ Difficult	-

Source: JICA Project Team

○: Relatively advantageous compared to other candidate sites

△: Problematic compared to other candidate sites



Source: JICA Project Team

Figure 2-2-3 USPNet Structure after the Construction of the Secondary Hub Station

[7] Optical submarine cable between Tonga and Fiji was connected in August 2013 and in the same year USPNet has started its services as optical submarine cables network

(4) Policy on Natural Conditions

1) Temperature and Humidity

Since the main items for the satellite communication system to be procured in the Project, except for parabolic antenna, will be used indoors in an air-conditioned environment, it will not be necessary to take any special measures regarding outside temperatures and humidity.

2) Salt Damage

The scheduled site for construction of the New Hub Station Building and installation of parabolic antenna at the Project site is located approximately 900 meters from the coast. This location corresponds to areas subject to salt damage under Japanese definitions. Therefore, salt-resistant specifications will be considered. The external mortar walls of the New Hub Station Building needs to be painted and equipment that will be installed outside, such as the parabolic antenna, needs to undergo an application of hot-dip galvanizing as long as possible. Also USP will apply a salt-resistant paint such as an epoxy adhesive to the equipment to prevent salt damage.

3) Cyclones

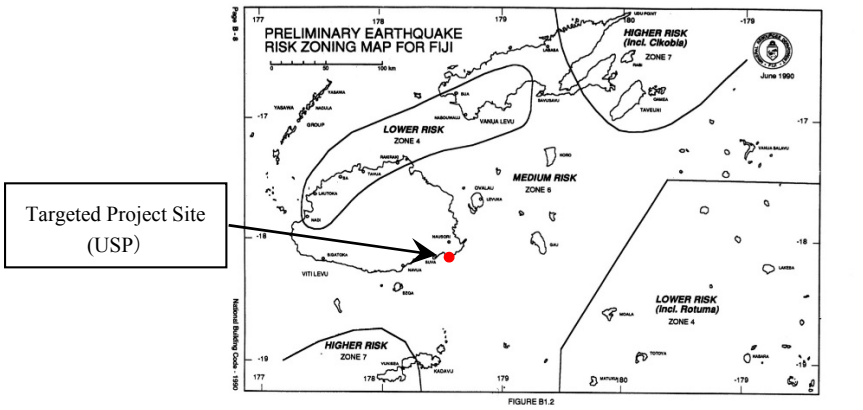
In consideration with the wind speed as stated in 1-2-2, antennas and buildings need to be constructed sufficiently strong to be able to bear a maximum instantaneous wind velocity of 90 m/s and a maximum wind velocity of 60 m/s. The new parabolic antenna will be designed to adjust its elevation angle in order to reduce the wind pressure load so it can withstand powerful cyclones such as Winston.

4) Lightning Strikes

As stated in 1-2-2, there occur many lightning strikes in November and December in Suva. In order to protect equipment from the lightning strikes, two (2) lightning conductors will be installed on the top of the parabolic antenna.

5) Seismic Conditions

The records indicate that there are no large earthquakes in Fiji. However, the designs for the New Hub Station Building and the parabolic antenna foundations will comply with the National Building Code of Fiji and with Japanese structural standards. Figure 2-2-4 shows a preliminary earthquake risk zoning map for Fiji based on the National Building Code of Fiji. In the figure, areas which tend to suffer damages by earthquakes are classified in accordance with extent of the risk and seismic coefficient and standard for wind-resistance design are set in each area. Targeted areas in the Project belong to ZONE6 (MEDIUM RISK: Areas with relatively high risk), hence its seismic coefficient will be applied for the design of construction and installation.



Source: National Building Code Fiji

Figure 2-2-4 Preliminary Earthquake Risk Zoning Map for Fiji

(5) Policy on Social Conditions

The ethnic composition of Fiji is 56.8 % Melanesian, 37.5 % Indian and 5.7 % others. The official languages are Fijian, Hindi and English. The lands of Fiji are spread over a wide area of the South Pacific, and the majority of the citizens living in islands far from Viti Levu, such as the Lau Group, are Melanesian descent. Most of those of Melanesian descent are Christian and most of those of Indian descent are Hindu, and therefore there are few religious observances or cultural events such as Ramadan which could affect the work period of the Project.

(6) Policy on Construction Conditions

In Fiji, public and commercial facilities are usually in medium-sized buildings (around ten storeys), while other most buildings are two-storey structure in general. Local construction companies have the capacity to build such medium-scale reinforced concrete structures, and are thus capable of undertaking construction of the New Hub Station Building and antenna foundations for the Project. There are no problems foreseen regarding procurement of construction materials, workers and heavy construction machinery. Concrete made from locally produced aggregate and river sand is of a sufficient quality. Quality standards for construction materials are based on Australian and New Zealand standards. As for safety management during the construction, the Project will not have a large effect on local areas since the Project site is located in the Laucala campus in Suva. However, care will need to be taken regarding fences and other countermeasures to protect students and librarians and to ensure the safety of workers.

(7) Policy on Procurement Conditions for Third Countries

USP would strongly prefer to procure equipment from Japan since Japanese equipment is generally high quality and reliable. Furthermore, spare parts can be procured in Fiji through distributors if Japanese equipment is used. The main equipment in the existing hub stations operated at the Laucala campus for USPNet was produced in Japan and set up in 2000. Therefore, the staff at these

stations is already knowledgeable in the operation and maintenance of the system. For these reasons, the satellite communication system that will be procured for the Project will mostly be obtained from Japan. Air conditioning equipment and some other equipment which cannot be found in Japan will be procured from third countries. Table 2-2-4 shows a list of equipment to be procured from third countries. USP has experience in operating equipment made in third countries and it will be possible to sustain and manage this equipment with some initial guidance and operating guidance from the distributors.

Table 2-2-4 List of Equipment to be Procured from Third Countries

No.	Item	Country of origin
4.	Baseband System	
4.1	Universal Satellite Hub	USA
4.2	Outbound Line Card	USA
4.3	Inbound Line Card	USA

Numbers in the table correspond with those in Table 2-2-6.
Source: JICA Project Team

(8) Policy on Transporting of Equipment

Total system of the Project shall be tested once in Japan. Therefore all the procured items will be shipped from Japan including the items which will be procured from third countries. These items should be packed neatly for enduring the shocks during long-term shipping, unloading at a port of landing and inland transportation to the site of the Project.

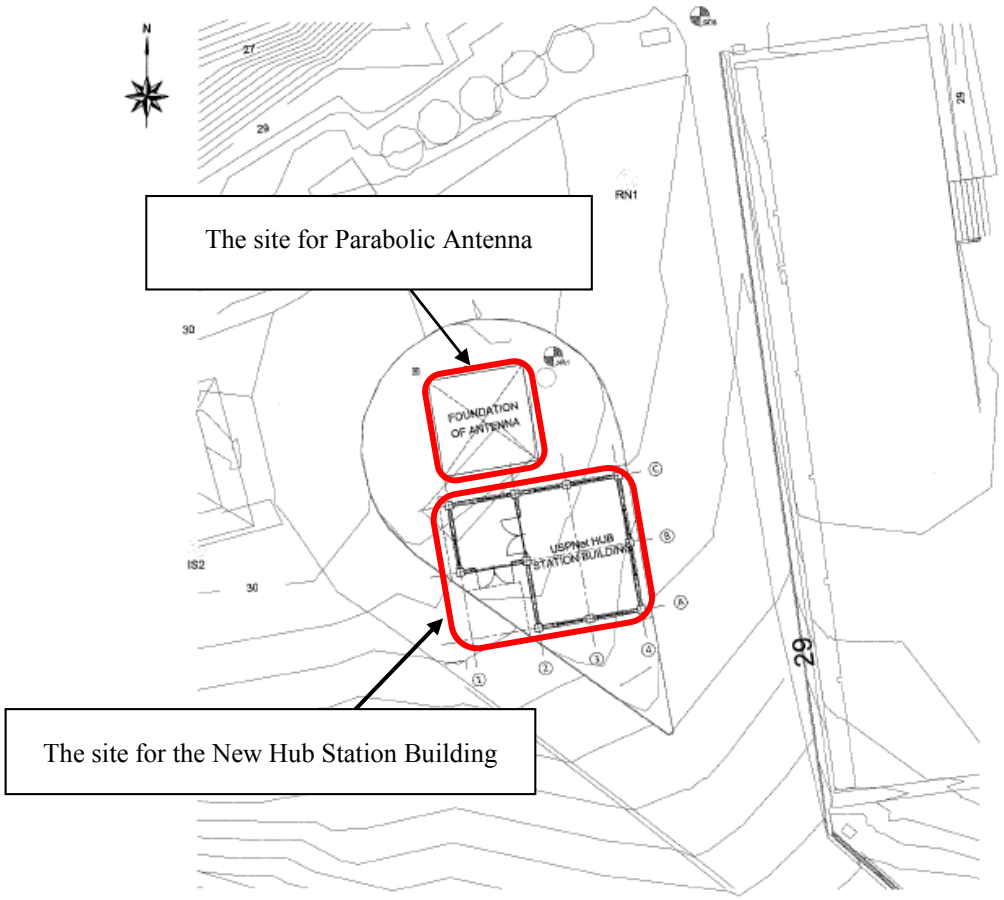
(9) Policy on Work Period

Since it will be necessary to hand the procured equipment over to the Fijian side within twenty-four (24) months from the signing of the Grant Agreement (G/A), some of the works, including construction of the New Hub Station Building, construction of the antenna foundations and installation of the antenna, need to be implemented within this period. Furthermore, before the Japanese side begins construction of the New Hub Station Building and the parabolic antenna foundation work, the Fijian side will need to secure the sites for the New Hub Station Building and installation of the parabolic antenna and will also need to complete all of the required applications and provide temporary storage areas and waste dumps. Moreover, before the Japanese side begins testing operations and adjustment after the installation work begins, the Fijian side will need to secure that the installation of facility for power supply has been finished. To ensure that the Fijian side can implement the works mentioned above without delay, the supervisors in charge of equipment procurement will administer appropriate advice and guidance to their counterparts.

(10) Policy on the Parabolic Antenna

1) Parabolic Antenna Sites

The candidate sites for the parabolic antenna were judged according to the following criteria: ① Ability to secure skylines with communication satellite, ② whether permission for construction can be obtained from USP, ③case of transporting and installing equipment, ④ whether there is sufficient ground strength. The site selected in conformance with the criteria above, as shown in Figure 2-2-5, is the appropriate point for installation of the parabolic antenna (weight: approximately 11 t), because the site has sufficient space for the New Hub Stations Building to be built, and it was confirmed by the geological survey results as shown in 1-2-5 that the site has enough ground strength with N Value (50 or more) and long-term permissible bearing capacity (300 kN/m^2 or more).



Source: JICA Project Team

Figure 2-2-5 Sites for New Hub Station Building and the Parabolic Antenna

2) Policy on the Shapes of the Parabolic Antenna

The existing C-band parabolic antenna dish is 7.6m in diameters. It is possible to introduce a parabolic antenna with smaller diameter by adopting Ku-band. On the other hand, in order to

maintain the same receiving levels from the satellite during times of rain, a 7 m diameter Ku-band parabolic antenna with a satellite tracking system and a control unit for transmitting power will be used.

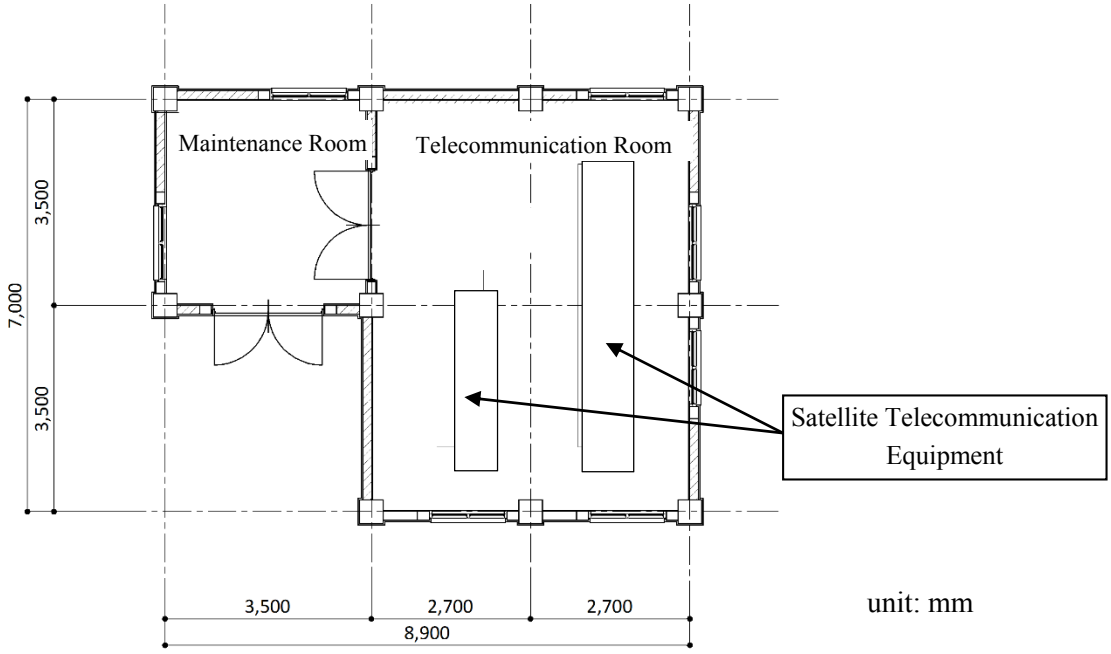
3) Policy on Construction of the Parabolic Antenna

Transmission radio waves from the parabolic antenna will be transmitted to the satellite via the horn, sub-reflector, and main reflector (the received radio waves will be transmitted in reverse). It is important to assemble the parabolic antenna correctly under guidance of Japanese engineers, because the state of installation of the parabolic antenna greatly affects directivity of radio waves. The workspaces will be 5 to 10 meters above ground level, therefore it will be necessary to set up scaffold for appropriate work environment. In addition, workers will thus need to use safety belts and other safety measures for working at heights.

(11) Policy on the New Hub Station Building

At the site next to the New Hub Station Building, a 7 m diameter parabolic antenna will be established. The New Hub Station Building will be a single-storey building with a room for communication equipment and a maintenance room. The structure of the building will consist of reinforced concrete, rahmen structure and concrete blocks, in consideration of the possibility of cyclones. In addition, the seismic coefficient adopted for structural calculation will be based on the "Fiji National Building Code", and the earthquake stratum shear force coefficient will be 0.1. The structure calculations will be done according to Japanese structural standards. Sufficient bearing capacity of the ground at the site for the New Hub Station Building needs to be secured as in the case for the parabolic antenna. Furthermore, the site for the New Hub Station Building is at high ground, and thus there is little concerns over problems arising due to ground water. The site is thus suitable for the New Hub Station Building.

Figure 2-2-5 shows the site for the New Hub Station Building and Figure 2-2-6 shows planar drawings for the New Hub Station Building.



Source: JICA Project Team

Figure 2-2-6 The New Hub Station Building Plane Drawings

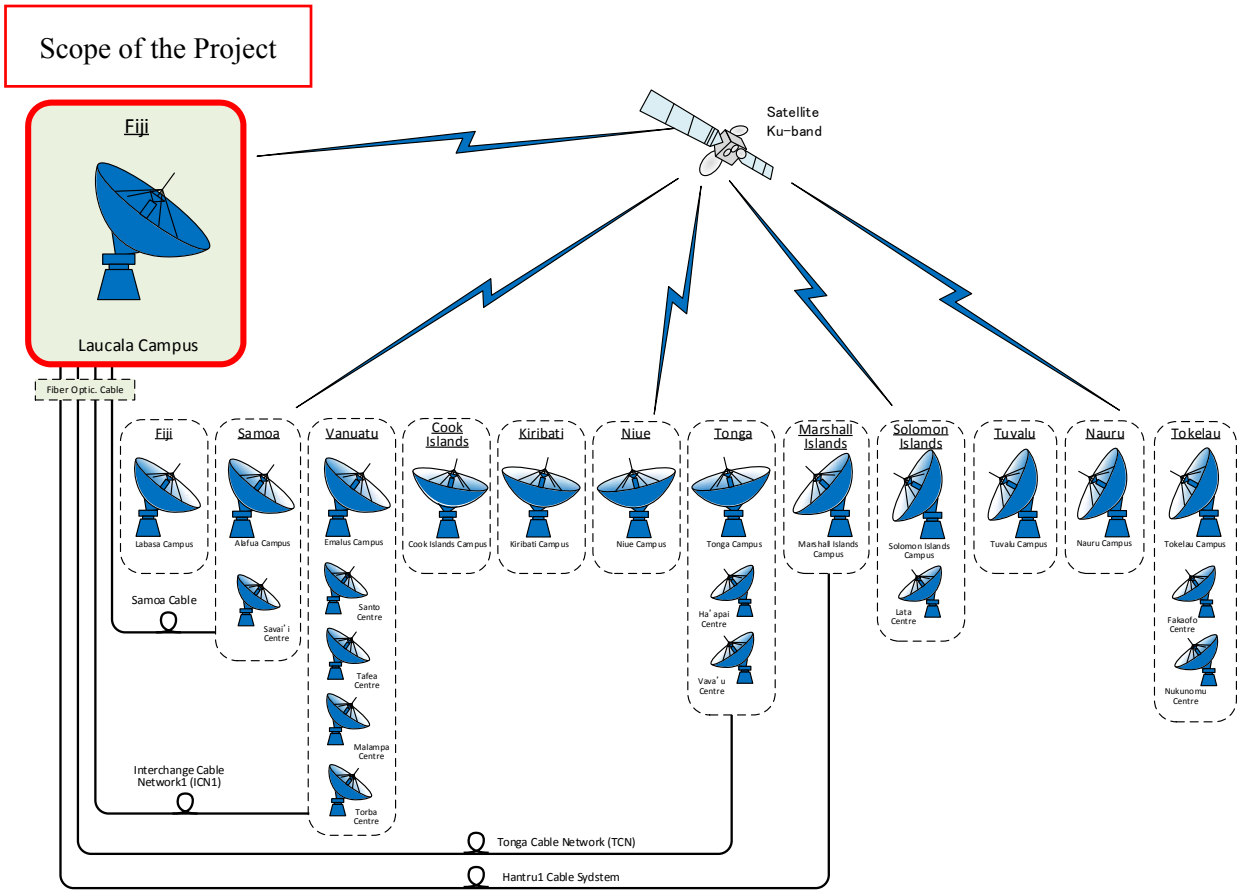
(12) Policy on Power Supply Equipment

The distribution line voltage at Laucala campus is 11 kV, and the voltage will be dropped to AC 415 V (three-phase) / AC 240 V (single-phase) in locations where electricity is needed. Moreover, emergency power generators will be deployed at strategic locations as a precaution against power outages. The New Hub Station Building will be supplied with AC 415 V and AC 240 V by the recipient (the Fijian side). Emergency power generators for the New Hub Station Building will also be supplied by the recipient (the Fijian side). The equipment installed in the New Hub Station Building will be supplied with 240 V, single-phase electric power and an uninterruptible power supply (UPS) will be installed as a precaution against power outages. Moreover, a storage battery for the uninterruptible power supply (UPS) that can store sufficient power to provide electricity to all of the equipment for 10 minutes will be provided, in consideration of the startup time of the emergency generator.

2-2-2 Basic Plan

(1) Outline of the Project

The network plan for USPNet that will be implemented after completion of the Project is shown in Figure 2-2-7. The Project scope in regard to USPNet is limited to updating the equipment in the New Hub Station Building in Laucala campus of USP. Improvement of remote stations and the like, which are the receiver's side for distance learning system, will be supplied by the Government of New Zealand.



Source: JICA Project Team

Figure 2-2-7 USPNet Network System

(2) Design Conditions

1) Weather and Site Conditions

① Outside temperature: Outside temperature 35 °C
Maximum temperature for resistance 40 °C

② Mean rainfall: 136.4 ～ 485.4 mm per month

③ Maximum wind velocity: 10.8 ～ 22.1 m/s

④ Site altitude (altitude above sea level): 30 m
(At the site for construction of the New Hub Station Building and parabolic antenna)

2) Applicable Standards

A list of applicable standards for the Project is given in Table 2-2-5.

Table 2-2-5 List of Applicable Standards

	Name of Standard	Application
(a)	International Electro technical Commission (IEC)	All electronic products
(b)	International Organization for Standardization (ISO)	All industrial products
(c)	Japanese Industrial Standards (JIS)	All industrial products

	Name of Standard	Application
(d)	Japanese Electro technical Committee (JEC)	All electronic products
(e)	The Japan Electrical Manufacturers' Association (JEM)	All electronic products
(f)	Japan Electric Association Code (JEAC)	All electronic products
(g)	The Japanese Cable Makers' Association Standard (JCS)	Electrical cables
(h)	Electronic Industries Association of Japan (EIAJ)	All electronic products
(i)	International Telecommunication Union (ITU)	All electronic products
(j)	Electronic Industries Alliance (EIA)	All electronic products
(k)	Federal Communications Commission (FCC)	All telecommunications equipment
(l)	Japan's Building Standards Act	Building design
(m)	National Building Code of Fiji	Building design, antenna design

Source: JICA Project Team

(3) Equipment Composition

Table 2-2-6 shows a list of the system equipment (hereinafter referred to as "the Equipment") which will be procured in the Project.

Table 2-2-6 List of the Equipment

No.	Item	Q'ty
1.	Parabolic Antenna System	
1-1	Ku-band Parabolic Antenna with Electric Drive Unit for AZ/EL/POL Direction	1 set
1-2	Beacon Receiver	1 set
1-3	Receiving Frequency Converter (for Beacon Receiver)	1 set
1-4	Control Unit for Parabolic Antenna	1 set
1-5	Drive Unit for Parabolic Antenna	1 set
2.	Low Noise Converter System	
2-1	Hot stand-by System for Low Noise Converter	1 set
2-2	Power Unit for Low Noise Converter	1 set
2-3	Selection Device for Low Noise Converter	1 set
2-4	Distribution Device	1 set
2-5	Monitoring Device for IF	1 set
3.	Block Up Converter System	
3-1	Hot stand-by System for Block Up Converter	1 set
3-2	Interface Device	1 set
3-3	Selection Device for Block Up Converter	1 set
3-4	Control Unit for Transmitting Power	1 set
4.	Baseband System	
4-1	Universal Satellite Hub	1 set
4-2	Line Card for Outbound	2 set
4-3	Line Card for Inbound	2 set
5.	Monitoring and Control System for Hub Station	
5-1	Monitoring system	1 set
5-2	Control System	1 set
6.	Uninterruptible Power Supply (UPS)	1 lot
7.	Lightning Protection Device	1 lot
8.	Measuring Instrument	
8-1	Spectrum Analyzer	1 set
8-2	Power Meter	1 set
8-3	Frequency Counter	1 set
9.	Spare Parts	

No.	Item	Q'ty
9-1	Low Noise Converter System	1 set
9-2	Block Up Converter System	1 set
9-3	Line Card for Outbound	1 set
9-4	Line Card for Inbound	1 set
9-5	Power module for Baseband System	1 set
9-6	Feed Horn Cover	1 set
10.	Consumable Material	
10-1	Grease for Parabolic Antenna	1 set

Source: JICA Project Team

(4) Spare Parts and Consumable Parts

Spare parts and consumable parts of the system mainly consist of the parts that could interrupt continuous operation of the system in the event of failure after completion of the Project and the parts that will be used frequently and have a shorter service life than other parts. Table 2-2-7 shows a list of spare parts and Table 2-2-8 shows a list of consumable parts.

Table 2-2-7 Spare Parts

No.	Item	Q'ty	Purpose of use
9.	Spare Parts		
9-1	Low Noise Converter System	1 set	Converting frequency of radio waves received via antennas from 12 GHz bandwidth satellites into 1 GHz bandwidth.
9-2	Block Up Converter System	1 set	Spare parts for Hot stand by System for block up converter system of No.3.1 in Table 2-2-6
9-3	Outbound Line Card	1 set	Multiplexing and modulating signals sent from Hub Stations using Time Division Multiplexing (TDM) method, thereafter transmitting the signals. Receiving and demodulating signals sent from remote stations using Time Division Multiple Access (TDMA) method, thereafter transmitting signals as IP packets. Each signal above receives and transmits one stream.
9-4	Inbound Line Card	1 set	Receiving and demodulating multiple TDMA signals, thereafter outputting the signals as IP packets. Streams of at most 16 channels can be handled.
9-5	Power Module for Baseband System	1 set	Power module of Universal Satellite Hub of No.4.1 in Table 2-2-6
9-6	Feed Horn Cover	1 set	A protect cover installed at the point of cylindrical part for signal reception and transmission (feed horn) of central part of parabolic antenna

Numbers in the table correspond with those in Table 2-2-6.
Source: JICA Project Team

Table 2-2-8 Consumable Parts

No.	Item	Q'ty	Purpose of use
10.	Consumable Parts		
10-1	Grease for Parabolic Antenna	1 set	Lubricant for smooth working of moving part of parabolic antenna

Numbers in the table correspond with those in Table 2-2-6.
Source: JICA Project Team

(5) Building Plan (New Hub Station Building)

1) Plan Outline

The interior room sizes of the New Hub Station Building have been determined in order to meet the condition of securing the minimum required area for the Equipment to be installed. Table 2-2-9 is the plan outline of the New Hub Station Building.

Table 2-2-9 Plan Outline

Plan Outline for the New Hub Station Building		
(1) Room size	Telecommunications Room:	37.8 m^2
	Maintenance Room:	12.3 m^2
	Total:	50.1 m^2
(2) Eaves Height:	GL+3.9 m	
(3) Structural form:	Reinforced concrete built , one-storey	
(4) Facility	Electrical facilities, distribution board, lighting, air conditioning	

Source: JICA Project Team

2) Structural Plan

The structural form of the single storey New Hub Station Building will be composed of reinforced concrete, rahmen structure and isolated footing.

3) Finishing Plan

In order to control the temperature of the rooms in light of the heat radiation from the equipment, the rooms will be equipped with air conditioners. Moreover, concrete roofs and external concrete block walls with thickness of 150 mm will be adopted in order to enhance the heat insulation and air tightness of the rooms. Because Fiji is an island country surrounded by the ocean, wooden doors and aluminum windows will be adopted for exterior fittings in consideration of resistance to salt damage. Table 2-2-10 shows the finishing plan for the rooms.

Table 2-2-10 Finishing Plan

Finishing Plan for the New Hub Station Building	
Common to Telecommunication Room and Maintenance Room	
Floor:	Dustproof paint
Baseboard:	Dustproof paint
Walls:	Concrete blocks, mortar trowel finishing and painting
Ceil:	Concrete repair, paint

Source: JICA Project Team

(6) Equipment Plan

1) Parabolic Antenna System

The parabolic antenna will be installed with an auto tracking system and the diameter of the antenna is 7 m or more. The reason for this is to prevent the reception level from decreasing when it rains. In addition, the Equipment which will be installed outside should be applied hot-dip galvanizing to the extent possible. In case hot-dip galvanizing is unavailable, salt-

resistant paint should be done. The specification of the parabolic antenna system is described in Table 2-2-11.

Table 2-2-11 Specification of the Parabolic Antenna System

No	Specification of the Equipment
1-1	Ku-band Parabolic Antenna with Electric Drive Unit for AZ/EL/POL Direction
	- Antenna model: Cassegrain type - Diameter of main reflector: 7.0 m or more - Drive for AZ/EL/POLdirection: Manually or electrically ＊AZ: Azimuth angle, EL: Elevation angle, POL: Polarized wave angle
1-2	Beacon Receiver
	- Input Frequency: 70MHz or 140MHz - Input Level: -20dBm to -60dBm
1-3	Receiving Frequency Converter (For Beacon Receiver)
	- Input Frequency Range: 0.95 to 1.45GHz - Output Frequency: 70MHz or 140MHz
1-4	Control Unit for Parabolic Antenna
	- Input Voltage: AC 240V ±10 %, Single-phase - Indicator: AZ and EL
1-5	Drive Unit for Parabolic Antenna
	- Input Voltage: AC 240V ±10 %, Single-phase - Output Voltage: AC 240V ±10 %, Single-phase

Numbers in the table correspond with those in Table 2-2-6.
Source: JICA Project Team

2) Low Noise Converter System

A redundant structure will be adopted to low noise converter system with active and backup (one to one) equipment and the system will switch to the backup system automatically if any failures occur to the currently working system. The specification of the low noise converter system is described in Table 2-2-12.

Table 2-2-12 Specification of the Low Noise Converter System

No	Specification of the Equipment
2-1	Hot stand by System for Low Noise Converter
	- Redundancy: One to One (1:1) - Range of Input Frequency: 12.25 to 12.75GHz - Range of Output Frequency: 0.95 to 1.45GHz
2-2	Power Unit for Low Noise Converter
	- Input Voltage: AC 240V ±10 %, Single-phase - Output Voltage: DC15V
2-3	Selection Device for Low Noise Converter
	- Input Voltage: DC15V - Function: Selection and Switching can be done automatically and/or manually
2-4	Distribution Device
	- Range of Input and Output Frequency: 0.95 GHz to 1.45GHz - Number of Port: Input 1 Port / Output more than 4 Ports
2-5	Monitoring Device for Interface (IF)
	- Range of Input and Output Frequency: 0.95 GHz to 1.45GHz - Number of Port: more than 2 Ports

Numbers in the table correspond with those in Table 2-2-6.
Source: JICA Project Team

3) Block Up Converter System

A redundant structure will be adopted to block up converter system with active and backup (one to one) procured equipment and the system will switch to the backup block up converter automatically if any failures occur to the currently working block up converter. The specification of the block up converter system is described Table 2-2-13.

Table 2-2-13 Specification of the Block Up Converter System

No	Specification of the Equipment
3-1	Hot stand by System for Block Up Converter
	- Redundancy: One to One (1:1) - Range of Input Frequency: 0.95 GHz to 1.45 GHz - Range of Output Frequency: 14.00 GHz to 14.50 GHz
3-2	Interface Device
	- Range of Input and Output Frequency: 0.95 GHz to 1.45GHz
3-3	Selection Device for Block Up Converter
	- Input Voltage: AC 240V ±10 %, Single-phase - Function: Selection and switching can be done automatically and/or manually
3-4	Control Unit for Transmitting Power
	- Range of Input and Output Frequency: 0.95 GHz to 1.45GHz - Control Method: Transmitting power can be done automatically and/or manually

Numbers in the table correspond with those in Table 2-2-6.
Source: JICA Project Team

4) Baseband System

The same Baseband System will be equipped to connect to the LAN network at the Laucala campus. The specification of the Baseband System is described in Table 2-2-14.

Table 2-2-14 Specification of the Baseband System

No	Specification of the Equipment
4-1	Universal Satellite Hub
	- Number of IF Modules: 5 (TX/RX IF) - Slot Number of Line Card: 20 Slots (4 Slots / IF) - Input Voltage: AC 240V ±10 %, Single-phase
4-2	Outbound Line Card
	- Method: DVB-S2/ACM
4-3	Inbound Line Card
	- Method: TDMA

Numbers in the table correspond with those in Table 2-2-6.
Source: JICA Project Team

5) Monitoring and Control System for Hub Station

Construction of the Second Hub Station is not within the scope of the Project, on the other hand, the monitoring and control system for the secondary Hub Station will be installed for smooth connection with the secondary Hub Station when the secondary Hub Station is constructed. The specification of the monitoring and control system for the secondary Hub Station is described in Table 2-2-15.

Table 2-2-15 Specification of the Monitoring and Control System

No	Specification of the Equipment
5-1	Monitoring System
	- Equipment to be monitored: Beacon receiver, receiving frequency converter, control unit for parabolic antenna, drive unit for parabolic antenna, low noise converter system, block up converter system, interface device and control unit for transmitting power
5-2	Control System
	- Equipment to be controlled: Beacon receiver, receiving frequency converter, control unit for parabolic antenna, drive unit for parabolic antenna, low noise converter system, block up converter system, interface device and control unit for transmitting power

Numbers in the table correspond with those in Table 2-2-6.
Source: JICA Project Team

6) Uninterruptible Power Supply (UPS)

The New Hub Station will be equipped with an Uninterruptible Power Supply (UPS) so operations can continue when power to USPNet is interrupted. The major specification of the UPS is described Table 2-2-16.

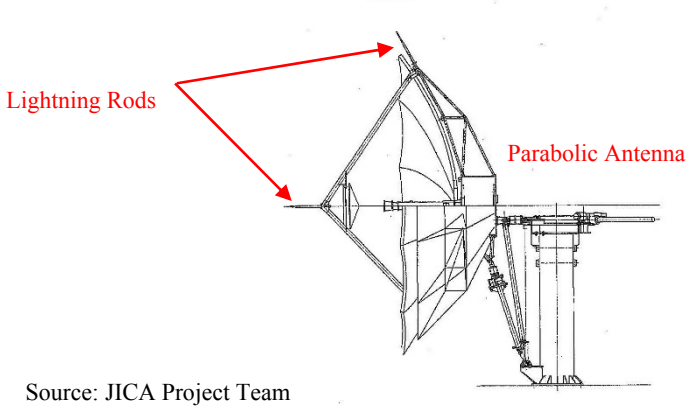
Table 2-2-16 Specification of the UPS

No	Specification of the Equipment
6	Uninterruptible Power Supply (UPS)
	- Output Capacity: 10kVA - Input Voltage: AC 415V ±10 %, 3-phase 4-wire - Output Voltage: AC 240V ±1 %, Single-phase 2-wire - Compensation Capacity: 10 min.

Numbers in the table correspond with those in Table 2-2-6.
Source: JICA Project Team

7) Lightning Protection Device

At the top of the parabolic antenna, two (2) lightning rods will be installed to protect the equipment from lightning. The lightning rods will be connected to ground with 60 mm^2 copper stranded wire in order to prevent the Equipment from suffering damage. Figure 2-2-8 shows the location of the lightning rod and specification of the lightning protection device is described in Table 2-2-17.



Source: JICA Project Team

Figure 2-2-8 Location of the Lightning Rods

Table 2-2-17 Specification of the Lightning Protection Device

No	Specification of the Equipment
7	Lightning Protection Device
	- Lightning Conductor: 60mm^2 Copper stranded wire - Earth Plate: Cu 1.5mm x 900mm x 900mm

Numbers in the table correspond with those in Table 2-2-6.
Source: JICA Project Team

8) Measuring Instrument

One each of a spectrum analyzer, power meter and frequency counter will be procured for maintenance and inspection.

9) Spare Parts

The spare parts needed for a period of one year after commencement of operations will be procured.

10) Consumable Parts

The consumable parts needed for the period of one year after commencement of operations will be procured.

2-2-3 Outline Design Drawings

The outline design drawings for the Equipment targeted in the Project are indicated in Table 2-2-18. The outline design drawings is referred to Appendix 5.

Table 2-2-18 List of the outline design drawings

No.	Names
G-01	LOCATION OF THE PROJECT SITE
A-01	USPNet HUB STATION BUILDING SITE PLAN
A-02	USPNet HUB STATION BUILDING FLOOR PLAN
A-03	USPNet HUB STATION BUILDING ELEVATION & SECTION PLAN
E-01	USPNet HUB STATION BUILDING LAYOUT PLAN
E-02	USPNet HUB STATION BUILDING ELECTRICAL EQUIPMENT
E-03	USPNet HUB STATION BUILDING LIGHTING, SOCKET OUTLET & AIR CONDITIONER PLAN
E-04	USPNet HUB STATION BUILDING INSTALLATION PLAN FOR SATELLITE COMMUNICATION EQUIPMENT, CABLE DUCT & CABLE RACK
E-05	USPNet HUB STATION BUILDING PLAN FOR LIGHTNING PROTECTION
F-01	USPNet HUB STATION FOUNDATION OF PARABOLIC ANTENNA
T-01	NEW USPNet WITH Ku BAND
T-02	USPNet Ku BAND HUB STATION BLOCK DIAGRAM
T-03	USPNet Ku BAND HUB STATION SYSTEM BLOCK DIAGRAM WITH ITEM NO.
T-04	ANTENNA EQUIPMENT

Source: JICA Project Team

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The Project will be implemented on the basis of Japan's Grant Aid scheme. It will thus be implemented after approval is granted by the Government of Japan and the Exchange of Notes (E/N) and the Grant Agreement (G/A) are signed by the Government of Fiji and the Government of Japan. The following paragraphs describe the basic points that require particular consideration when implementing the Project.

(1) Project Implementing Agency

The Project implementing agency on the Fijian side is USP, while the Ministry of Education, Heritage and Art is the agency responsible for the Project. USP is jointly run by twelve countries and regions and provides higher education services through its USP Centre. The decision-making for USP is conducted by the Council. The Information Technology Service (hereinafter referred to as ITS) operates within USP and maintains USPNet under the administrative division. In order to ensure that the Project advances smoothly, it will be necessary for ITS to conduct close liaison and discussions with the Japanese consultant (hereinafter referred to as "the Consultant") and Japanese supplier (hereinafter referred to as "the Supplier") and to appoint personnel in charge of the Project.

(2) Consultant

In order to implement the procurement and installation of the Equipment in the Project, the Consultant will conclude a design supervision contract with USP and carry out the implementation design and supervise the execution. Also, the Consultant will prepare tender documents and conduct the tender on behalf of USP (the Project implementing agency).

(3) Japanese Supplier

In accordance with the framework of Japan's Grant Aid scheme, the Supplier that has been selected by the Fijian side in a competitive tender will implement the Equipment procurement, installation works, initial guidance, operating guidance and on-the-job trainings for the Project. Since it will be necessary to continue supplying spare parts and conducting post-installation services to resolve breakdowns and the like after the completion of the Project, it will be essential for the Supplier to establish a liaison with USP after the handover of the Equipment.

(4) Dispatch of Engineers

The Equipment of the Project comprises instruments for use in satellite communication stations. It will be inspected in Japan before being shipped to Fiji. Therefore, because high-level technology will be needed to install the Equipment and to conduct post-installation testing, adjustment, etc., it will be necessary to dispatch engineers from Japan to carry out quality control and technical guidance and to schedule control activities.

2-2-4-2 Implementation Conditions

Workers for the construction work in Fiji can be readily secured. However, there are few skilled workers or engineers specializing in scheduling, quality, safety, etc. control technologies. Therefore, it will be necessary for the Supplier to dispatch skilled workers and engineers from Japan to Fiji as needed. As items such as the construction machines required for the construction of the New Hub Station Building and the parabolic antenna foundation, the aggregate, and so on, can be procured in Fiji. The construction machines required for the inland transportation and installation of the Equipment can also be procured in Fiji. The major points to bear in mind regarding the implementing conditions are described below.

- The Project sites for the New Hub Station Building are located at a USP campus, and students, staff, visitors and so on are able to enter. Therefore, safety fences and the areas to which entry is prohibited must be specified and clearly marked.
- The construction will be carried out during cyclone season. Thus, weather information should be carefully noted, and of a cyclone is predicted, measures must be taken to secure materials to prevent them from flying around and causing accidents.
- The work will be conducted in locations 5 to 10 meters above ground. When assembling the parabolic antenna, safety belts and other necessary measures will be required to ensure worker safety.
- The baseband system procured in the Project will replace to the existing baseband system.

2-2-4-3 Scope of Works

The Japanese side will be responsible for construction of the New Hub Station Building and procurement and installation of the Equipment for the satellite communication system, while the Fijian side will be responsible for securing locations for the constructions. Table 2-2-19 shows the demarcation of the work and costs for the Project.

Table 2-2-19 Demarcation of the Work and Costs for the Project (draft)

(1) Before the Tender

No.	Undertaking	To be covered by		Notes
		Japan	Fiji	
1	Approving EIA and securing the necessary budget for implementation		●	If EIA is necessary, complete within 1 month after G/A
2	Preparing the communication satellite line for Ku-band (transponder output of 150 W and frequency bandwidth of 20 MHz)		●	Acquire necessary permission before E/N signature.
3	Opening bank account by Banking Arrangement (B/A)		●	Complete within 1 month after G/A
4	Bearing the following commissions to a bank in Japan for banking services based upon the B/A			
	(1) Advising commission of Authorization to Pay (A/P)		●	For the consulting services
	(2) Payment commission		●	Advance payment for consultation

No.	Undertaking	To be covered by		Notes
		Japan	Fiji	
5	Determining the location for the Secondary Hub Station		●	
6	Completing the authorization for construction work related to the New Hub Station		●	Complete before bid notice
7	Obtaining the confirmation letter for new frequencies for the satellite communication line		●	Complete before bid notice
8	Securing of lands (hereinafter referred to as "the Project sites") for the buildings and the installation of the Equipment, bush clearing and removal of obstacles at the Project sites (ground/underground)		●	Complete before bid notice
9	Constructing access roads to the Project sites, if necessary		●	
10	Submitting Project Monitoring Report (together with the result of the detailed design)		●	

Remark: ● denotes the side responsible for the work

(2) During the Project Implementation

No.	Undertaking	To be covered by		Notes
		Japan	Fiji	
1	According to Japanese nationals and/or physical persons of third countries 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 the recipient country and stay therein for the performance of their work		●	
2	Bearing the following commissions to a bank in Japan for banking services based upon the B/A			
	(1) Advising commission of Authorization to Pay (A/P)		●	For the construction work undertaken by the Contractor
	(2) Payment commission		●	For the contract for consulting service and Contractor's works
3	Assuring the security of personnel at the Project sites, when necessary		●	
4	Procuring the Equipment for the New Hub Station Building construction	●		Procurement of the Equipment are described in Table 2-2-6
5	Securing the following storage spaces, facilities, sites, yards, etc.: (1) Storage spaces for the Equipment at USP (2) Temporary offices for the Consultant and the Contractor (3) Locations for temporary assembly (4) Locations for disposal of waste		●	Complete before the commencement of the installation work
6	Ensuring that custom duties, internal taxes and other fiscal levies which may be imposed in the country of the recipient with respect to the purchase of the products and/or the services be exempted, such as, (1) Import Duties, (2) Consumption Tax (VAT), (3) Other duties, taxes or levies, if any		●	Complete before the commencement of the installation work
7	Transporting of the Equipment, customs procedures and tax procedures			
	(1) Marine/air transportation to a port of disembarkation in Suva, Fiji	●		
	(2) Storage of the Equipment at the port of disembarkation		●	

No.	Undertaking	To be covered by		Notes
		Japan	Fiji	
	(3) Procedures for tax exemption and customs clearance at the port of disembarkation		●	
	(4) Inland transportation from the port of disembarkation to the storage at the Project site.	●		
8	Obtaining a confirmation letter for: (1) Permission to undertake the Installation work at the Project sites (2) Permission to enter the Project sites		●	
9	Preparing LAN network at the New Hub Station Building		●	Complete before the commencement of the installation work (LAN cables will reach up to the New Hub Station Building)
10	Changing existing distribution line, if necessary		●	
11	Installing the Equipment, adjusting and testing the equipment (with New Hub Station Building)	●		
12	Confirming that the satellite communication line can be used		●	Complete before the completion of the installation work
13	Providing facilities for the distribution of electricity, water supply, drainage and incidental facilities to the New Hub Station			
	(1) Electricity			
	1) Electricity AC 415V / 240V, 3-phase 4-wire to the New Hub Station Building		●	Complete before the commencement of the installation work
	2) Electrical wiring in the New Hub Station Building	●		
	3) Main circuit breaker and transformer in the New Hub Station Building	●		
	4) Emergency generator and power switch for the New Hub Station Building in case of power outage.		●	Complete before the completion of the installation work
	(2) Water supply (for the New Hub Station Building)		●	Complete before the commencement of the installation work
	(3) Drainage (from the New Hub Station Building)		●	Complete before the commencement of the installation work
	(4) Incidental facilities		●	Complete before the commencement of the installation work
14	Providing security for the Equipment during the implementation of the installation work	●		
15	Installing fences and doors for the New Hub Station Building		●	Complete before the completion of the installation work
16	Operations and maintenance after handover of the Equipment	●		
17	Bearing all expenses other than those covered by the Grant Aid, necessary for the implementation of the Project		●	
18	Submitting Project Monitoring Report			
	1) Progress of each phase of work		●	
	2) After completion of work		●	

Remark: ● denotes the side responsible for the work

(3) After the Project

No.	Undertaking	To be covered by		Notes
		Japan	Fiji	
1	Providing security to the buildings and the Equipment of the New Hub Station after handover		●	
2	Implementing operations and maintenance for the New Hub Station, including routine checks/periodic inspections and cleaning		●	
3	Allocating necessary staff and budget to establish proper operations and maintenance structures, including routine checks/periodic inspections and cleaning.		●	
4	Replacing remote stations (including refurbishment of remote station equipment)		●	Update, arrange and examine equipment at fourteen remote stations operated with C-band and nine remote stations operated with Ku-band

Remark: ● denotes the side responsible for the work

Source: JICA Project Team

There are plans to upgrade the satellite communication equipment using funds from the Government of New Zealand at USPNet remote stations. With the consolidation of satellite communication line into Ku-band under the Project, switching work for adaptation to Ku-band equipment will be required at fourteen remote stations operating with the C-band and at nine remote stations operating with the Ku-band. As a reference, contents and categories of remote station switching work described in No.4 of Table 2-2-19 (3) are indicated in Table 2-2-20.

Table 2-2-20 Contents and Categories of Remote Station Switching Work

Task		Description	Location	
			Remote Station	Hub Station
1. Remote stations using C-band equipment (14 stations)				
	(1) Equipment upgrades	Upgrade outdoor units, including C-band parabolic antenna, and indoor units	○	
	(2) Antenna direction adjustments	Adjust antenna direction (elevation, azimuth) while receiving test radio waves from the Hub Station	○	
	(3) Communication satellite access test	Discharge test radio waves from remote stations through remote operation from the Hub Station, and perform confirmation test of the communication satellite company (control station). If re-adjustment of the antenna direction of remote stations is necessary, the Hub Station will communicate the instructions from the communication satellite company (control station) to the remote stations, and the remote stations will make slight adjustments to the antenna direction (elevation, azimuth) in accordance with the instructions.	△	○
	(4) Network connection test	Conduct a network connection test with remote stations from the network management system (NMS) of the New Hub Station's baseband system.	△	○

Task	Description	Location	
		Remote Station	Hub Station
(5) Switching equipment of existing remote stations to new equipment and integration test	Switch the IP network on the remote station campus side from the existing remote station equipment to the new equipment. After switching, connect to the distance learning application of the New Hub Station, and conduct mutual integration tests between the New Hub Station and the remote stations.	Δ	○
(6) Suspension of existing remote station equipment	Suspend the existing remote station equipment and cut off the power.	○	
2. Remote stations using Ku-band equipment (9 stations)			
(1) Changing the antenna direction	Suspend the Ku-band signal from existing hub station and direct of the remote station parabolic antenna towards the new communication satellite. If a skyline in the direction of the new communication satellite cannot be secured, move the antenna to a position where a skyline can be secured.	○	
(2) Antenna direction adjustments	Conduct antenna direction (elevation, azimuth) adjustments while receiving test radio waves from the New Hub Station.	○	
(3) Communication satellite access test	Discharge test radio waves from remote stations through remote operation from the New Hub Station, and perform confirmation test of the communication satellite company (control station). If re-adjustment of the antenna direction of the remote station is necessary, the New Hub Station will communicate the instructions from the communication satellite company (control station) to the remote stations, and the remote stations will make slight adjustments to the antenna direction (elevation, azimuth) in accordance with the instructions.	Δ	○
(4) Network connection test	Conduct network connection test with remote stations from the network management system of the New Hub Station's baseband system.	Δ	○
(5) Integration tests	After switching, connect to the New Hub Station remote education application, and conduct mutual integration tests between the Hub Station and the remote station.	Δ	○

○: Primary responsibility Δ: Secondary responsibility
Source: JICA Project Team

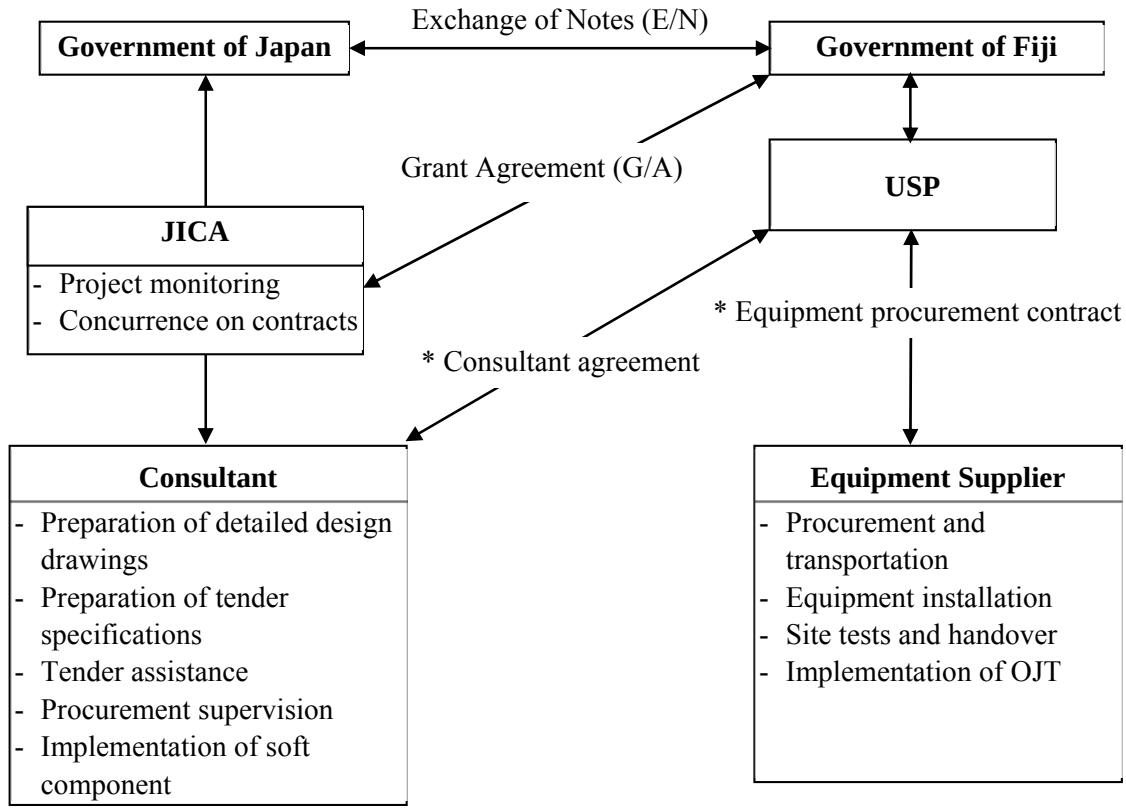
2-2-4-4 Consultant Supervision

(1) Basic Policy on Consultant Supervision

The Consultant has the obligation to organize a project team in charge of affairs of the Project and to smoothly execute the detailed design and the supervision work in accordance with the guidelines for Japan's Grant Aid and the outline design. The Consultant will dispatch specialist engineers according to the progress of the installation, onsite testing and adjustments, etc., and will guide and supervise the Supplier and strive to control the schedule, quality, progress, and safety on the basis of the plan. Also, the Consultant has the obligation to implement pre-shipping inspections of the

Equipment and to prevent any troubles from arising after the Equipment has been transported.

The major points to bear in mind regarding the supervision conducted by the Consultant are described below. Figure 2-2-9 shows the Project implementation relationships.



*Note: The Consultant agreement and the Equipment procurement contract require concurrence by JICA

Figure 2-2-9 Project Implementation Relationships

(2) Process Management

Every month or every week, the Consultant will compare the progress of the work with the implementation schedule determined by the Supplier and written into the contract in order to adhere to the delivery deadline given in the contract. In cases where delays are predicted, the procurement agent will warn the Supplier and demand the submission and implementation of a plan for countermeasures. Comparison of the planned schedule and the actual progress will be based primarily on the following items:

i. Confirmation of work performance (plant manufacturing and shipping performance)
ii. Confirmation of the Equipment delivery
iii. Supervision of the adherence to the implementation schedule

(3) Safety Control

Discussions will be held with responsible officers of the Supplier and their cooperation will be sought in the exercise of safety control during the construction period in order to prevent the occurrence of industrial accidents on the Project site, injuries to third parties, and other accidents. Important points to consider in safety management on the ground are as follows:

i. Establishment of safety control regulations and assignment of a manager
ii. Planning of operating routes for work vehicles and construction machinery and thorough enforcement of safe driving
iii. Encouragement of workers to utilize welfare measures and vacations
iv. Ensuring that security measures are taken during the stay

(4) Works Supervisor

The Supplier will procure and deliver the Equipment and implement the installation works. Since the Supplier will need to thoroughly ensure that the subcontractor complies with the schedule, quality, progress and safety measures prescribed for the work in the contract, the Supplier will dispatch engineers who have experience on similar projects in countries overseas to provide guidance and education on the ground.

2-2-4-5 Quality Control Plan

Quality control will be carried out on the basis of the following items to determine whether the Equipment satisfies the quality standards stated in the contract documents. In cases where doubts arise over the quality as a result of the confirmations and checks, the Consultant will immediately demand that the Supplier make amendments, revisions or corrections.

i. Checking of specifications of the Equipment
ii. Checking of shop drawings and specifications of the Equipment
iii. Conducting inspections of the Equipment at the plant and checking of inspection results
iv. Conducting inspections before shipment and checking of inspection results
v. Checking of installation guidelines
vi. Supervision of the Equipment installation work
vii. Checking and witnessing of trial operation, adjustment, testing and inspection results of the Equipment
viii. On-site adjustment for the Equipment and trial operation of the Equipment, conducting inspections and checking of inspection results

2-2-4-6 Procurement Plan

(1) Countries as Equipment Procurement Sources

The Equipment will mostly come from Japan and third countries since the Equipment is not

produced in Fiji. Table 2-2-21 shows the sources for the Equipment procurement sources.

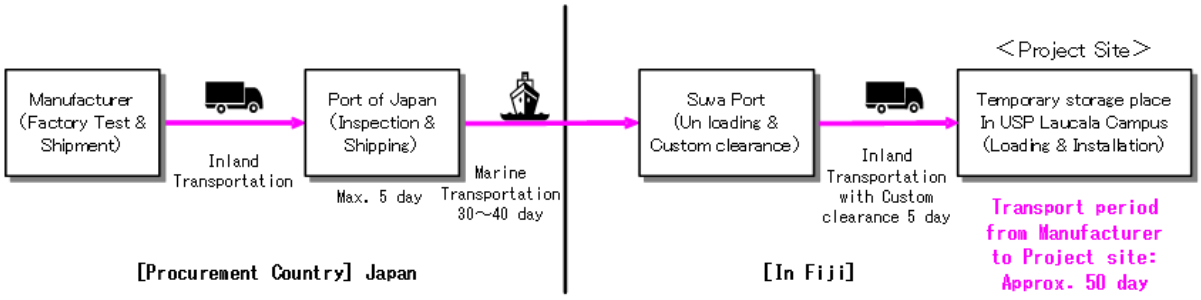
Table 2-2-21 Equipment Procurement Sources

No.	Item	Country of Origin		
		Japan	Fiji	Third Countries
1.	Parabolic Antenna System	○	-	-
2.	Low Noise Converter System	○	-	-
3.	Block Up Converter System	○	-	-
4.	Baseband System	○	-	○
5.	Monitoring and Control System for Hub Station	○	-	-
6.	Uninterruptible Power Supply (UPS)	○	-	-
7.	Lightning Protection Device	○	-	-
8.	Measuring Instrument	○	-	○
9.	Spare Parts	○	-	○
10.	Consumable Material	○	-	-

Source: JICA Project Team

(2) Equipment Transportation Plan

The Equipment shall be inspected in Japan even when the Equipment is made in a third country. Thus, procured items will be shipped to Japan before being delivered to Fiji. Figure 2-2-10 shows the Equipment transportation plan in the Project. The Equipment procured from Japan will primarily be transported overseas to the main port of Suva in Fiji. From there, the Equipment will be transported overland to the Project site, and no particular problems in inland transportation are anticipated because it takes about 20 minutes inside Suva. The required lead time for transportation from Japan to the Project site in Fiji, including customs clearance procedures at Suva Port, will be around 50 days at maximum. A packing method sufficient for enduring long-term shipping will be adopted, procedures for tax exemption, and customs clearance at the port of disembarkation will be undertaken, and internal transportation from the port of disembarkation to the Project sites will be carried out.



Source: JICA Project Team

Figure 2-2-10 Equipment Transportation Plan

In the Project, the Equipment will be classified into two groups and shipped to Fiji in accordance with the process of the Project and the lead-time of each equipment. Group 1 will include items related to the antenna foundation works and Group 2 will be shipped with the rest of the Equipment.

Group 1: Materials for antenna foundation

Group 2: The Equipment for satellite communication system, maintenance equipment and tools, spare parts and consumable materials

2-2-4-7 Plan for Initial Operations Guidance and Management Guidance, etc.

USP has managed and maintained a satellite communication hub station with the parabolic antenna whose diameter is 7.6 m and remote station satellite communication equipment since 2000, and has basic capabilities related to operations and management. There are currently approximately thirty staff members at ITS, and six of these staff members are responsible for management and maintenance of the satellite communication equipment. While the basic functions of the New Hub Station system to be procured in the Project are similar to the current system, the Project will equip the system with an automatic tracking function for the communication satellite, and will strengthen the functions of the communication system through means such as an active and backup redundant structure for low noise converter and block up converter. There had been an automatic tracking function previously but it was suspended approximately seven years ago. After installation, adjustments, and trial operations are completed, technical guidance (OJT) for management and maintenance personnel on initial operations and management using the new satellite communication equipment will be conducted by the Supplier. The technical guidance (OJT) items are indicated in Table 2-2-22.

Table 2-2-22 Technical Guidance (OJT)

Technical Guidance (OJT)		Details of Guidance
Initial operations guidance	Equipment operation, equipment status display	・ Explanation of procedures for starting and stopping the new Hub Station satellite communication equipment ・ Explanation of equipment status displays ・ Explanation of operation procedures for Hub Station monitoring and control system
Operations guidance	Inspection	・ Explanation of equipment operation methods, judgment criteria, inspection records, and measuring device connection methods related to routine and annual inspection items
	Breakdown response	・ Explanation of status (alarm) display, etc. during a breakdown. ・ Explanation of how to judge whether parts are damaged or defective, replacement methods for those parts and points to note regarding spare parts, breakdown recovery methods, etc.
	Management of measuring devices	・ Explanation of handling and routine management and storage methods of measuring devices used in inspections, etc.

Source: JICA Project Team

2-2-4-8 Soft Component (Technical Assistance) Plan

An overview of the soft component plan is indicated below. For details, refer to Appendix 3 “Soft Component Plan (draft)”.

(1) Background and Plan of Soft Component

For the operation and management of the Equipment, skill to operate/maintain the Equipment will be transferred to USP with fundamental guidance and operational guidance on maintenance, inspections, etc. by the Supplier. The current USP staff members do not have enough experiences for the migration of communication satellite nor enough knowledge that will be necessary for the consolidation of the two communication satellite systems, namely the C-band system and the Ku-band system, after the completion of the Project. The skills for the utilization of communication satellite line integrated with the Ku-band system and management technologies for active and backup redundant structure equipment are required to be learned by them. Meanwhile, their technical level can be considered to be low.

In light of this, there will be a soft component plan for the Project aimed at the learning of the New Hub Station connection (transfer) technologies, routine management technologies including routine inspections of the New Hub Station system, data collection, and management/failure analysis (transfer and routine management technologies), and technologies for the use or the utilization of the communication satellite system integrated with the Ku-band system (technologies for the use or the utilization of the communication satellite line).

(2) Objective of Soft Component

The objective is to improve the capabilities of the ITS personnel at USP responsible for the management and maintenance of USPNet in operation, maintenance, and management of USPNet, including the Equipment, after Ku-band integration. This will be done through systematic guidance on transfer and routine management technologies and technologies for the use or the utilization of communication satellite lines so that USPNet can be managed in a stable and highly reliable manner over the long term.

(3) Results of Soft Components

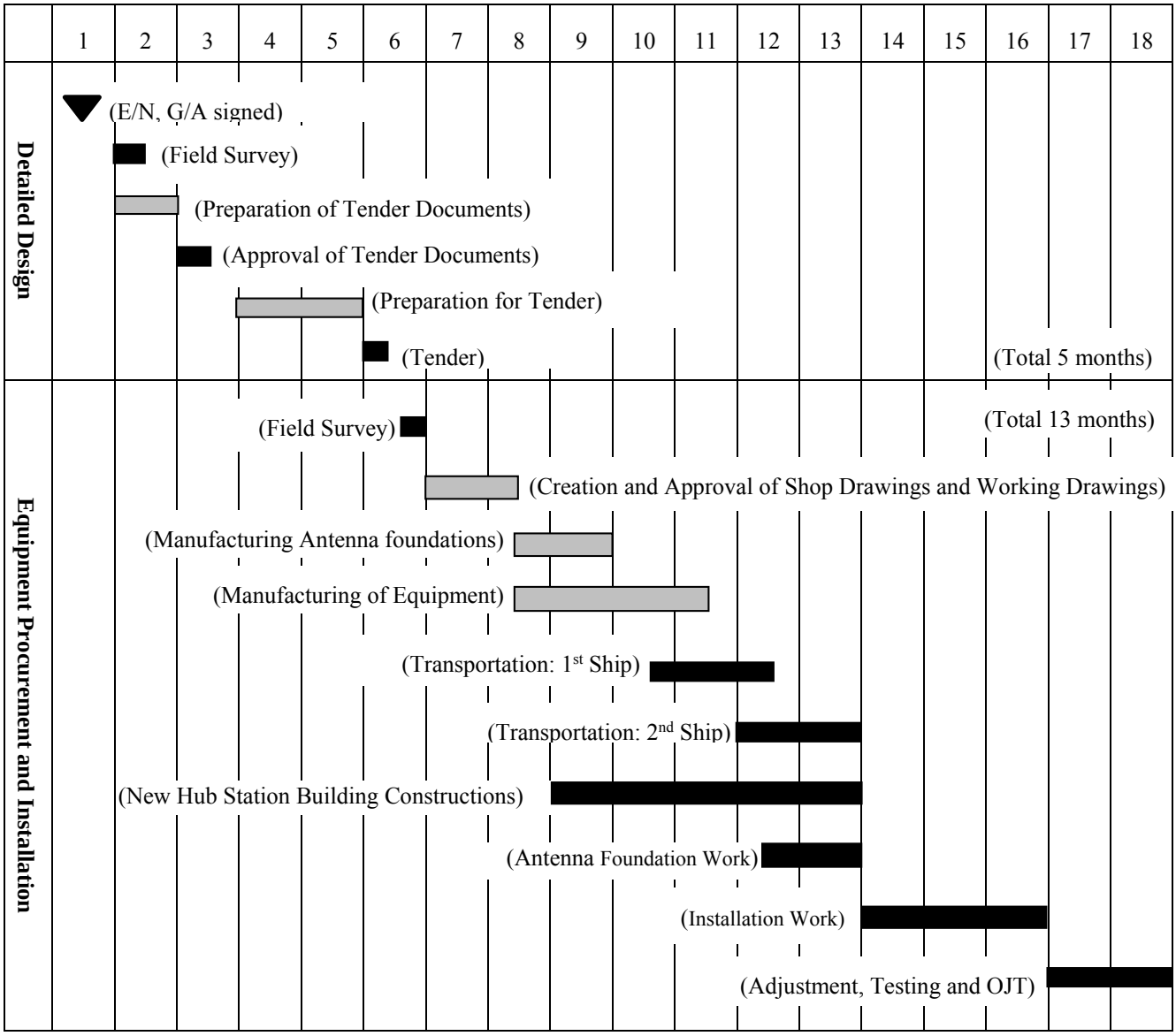
Standards documents, procedures documents, and manuals related to transfer management technologies, routine management technologies, and technologies for the use or the utilization of communication satellite lines will be developed through the implementation of soft components. It is expected that the utilization of standards documents, procedures documents, and manuals will improve capabilities in operations, maintenance, and management of USPNet.

2-2-4-9 Implementation Schedule

The Project implementation schedule has been compiled as shown below on the basis of Japan's Grant Aid guidelines. The equipment procurement and installation work will be implemented simultaneously following the implementation design, and the Project will take approximately 18 months.

Due to scheduling requirements, the construction of the New Hub Station Building must take place during cyclone season. During the period, the work should be undertaken carefully. In construction of the parabolic antenna foundation, the installation of the Equipment and procurement/testing operations of the Equipment will be undertaken after the cyclone season. Table 2-2-23 shows the Project implementation schedule.

Table 2-2-23 Project Implementation Schedule



Source: JICA Project Team

2-3 Obligations of Recipient Country

The Obligations for the Fijian side are mentioned in 2-2-4-3 and Table 2-2-19. The detailed procedures are as shown below.

2-3-1 Securing of Satellite Communication Network

The Fijian side will secure the communication satellite line of the Ku-band before signing of E/N. The conditions of the communication satellite line are a transponder output of 150 W and a frequency bandwidth of 20 MHz.

The Fijian side will update the equipment for the satellite communication system in the remote stations in order to unify USPNet after completion of the Project.

2-3-2 Commissions Paid to the Fijian Bank for Banking Services (Opening of Bank Account for Banking Arrangement (B/A) and Authorization to Pay (A/P))

The Fijian side will open a bank account by the timing of the consulting service agreement for Banking Arrangement (B/A) and Authorization to Pay (A/P)

2-3-3 Selections of Candidate Sites for Secondary Hub Station Building

In order to enhance the redundancy of USPNet, candidate sites for the secondary Hub Station Building will be selected in future and the necessary procedures will be conducted.

2-3-4 Procedures for Construction Work

The Fijian side including USP will secure sites and obtain any permissions needed for construction by the start of the construction work for the New Hub Station Building.

2-3-5 Removal of Obstructions

The Fijian side will remove obstructions such as containers from the skylines before the start of the parabolic antenna foundation work by the Japanese side and ensure availability of the skylines.

2-3-6 Temporary Storage Area

The Fijian side will provide a location close to the Project site where the Equipment and materials procured in the Project (equipment for communication systems including the parabolic antenna, measuring devices, etc.) can be temporarily stored and protected against theft until the end of the installation work.

2-3-7 Securing of a Waste Dump

The Fijian side will secure a site to dispose of the materials which will be generated during the construction work before the start of construction of the New Hub Station Building.

2-3-8 Tax Exemption Measures

The procedures for tax exemption measures and procedures of customs clearance for the Equipment are as shown below.

(1) For the Equipment and Materials Imported from Japan and/or Third Countries

- The Supplier will send shipping documents including a list of equipment to USP before loading the procured equipment and materials onto the ship in Japan and/or a third country.
- On the basis of the list of equipment, USP will conduct necessary procedures for receiving a concession letter which the Ministry of Finance will issue to USP for exemption of customs duties and added value tax.

(2) For the Equipment and Materials Procured in Fiji

- The Supplier will send a list of equipment to USP before purchasing the necessary equipment and materials in Fiji.
- USP will temporarily bear internal taxes and other fiscal levies on the equipment and materials.
- After completion of the procurement by the Supplier, USP will request and receive a refund for the internal taxes and other levies from the Fiji Revenuer and Customs Authority on the basis of the results of an assessment carried out by the Authority.

2-3-9 Securing of LAN Network in the New Hub Station Building

The Fijian side will need to secure use of the existing LAN system at the USP Laucala campus for the New Hub Station Building by the time of installation of the Equipment.

2-3-10 Testing Operations of Satellite Communication System

The Fijian side will need to be prepared to test satellite communications (transmitting of radio waves from the New Hub Station Building) at the request of the Japanese side before adjustment and testing operations of the Equipment are carried out.

2-3-11 Securing of Power Supply

The Fijian side will connect a power cable to the distribution panel in the New Hub Station Building from the existing power distribution line and secure a power supply before the start of adjustments and testing of the Equipment. Moreover, the Fijian side will need to provide generators in case of power outages.

2-3-12 Installation of Fences and Gates

The Fijian side will install security fences and gates around the grounds of the new parabolic antenna.

2-3-13 Replacement of Remote Stations

The Fijian side will update equipment for satellite communication at remote stations for unifying USPNet after the completion of the Project.

2-4 Project Operation and Maintenance Plan

2-4-1 Transfer of Operation and Maintenance Skills

Some of the Equipment for satellite communication network will have duplex active-backup configurations to secure redundancy. Once incident happens on the active equipment it can be switched to a backup equipment. Also it is planned to deploy a monitoring and controlling system for hub station in order to migrate USPNet promptly into the duplex configuration of hub stations in the future. The new satellite communication system will be operated and maintained differently compared to the previous method which ITS's engineers have been done. After installation of the Equipment, adjusting, and testing them, skill transfers and OJT will be conducted by the Supplier using the Equipment of the Project, aiming that the engineer's skill will be brushed up in order to secure stability and reliability of satellite communication network.

Furthermore, after the completion of the Project, the Government of New Zealand will support USP to update the equipment of satellite communication in remote stations, and thereafter, the equipment will be migrated into the new satellite communication network sequentially. It is expected in the Project that the USPNet staff will acquire skills for stable operation and maintenance of the system through providing the software component. The software components targets skills for migration of satellite communication network, utilization of satellite communication line which will be introduced by integrating current two satellite communication systems into one, and skills of guidance for USPNet staff in charge of operation at remote station.

2-4-2 Operations, Maintenance and Management Structure

In order to keep providing distance learning service stably and continuously, it is necessary for USP to appropriately operate and maintain USPNet, which is the infrastructure of distance learning. Accordingly, it is necessary to develop a budget for operations, maintenance, and management costs at USP and to procure and upgrade USPNet equipment on the basis of planning. Organizational structure for the operations, maintenance, and management of the Equipment will be the one aimed at regular equipment upgrades. Table 2-4-1 indicates the equipment maintenance and upgrade plan.

Table 2-4-1 Equipment Maintenance and Upgrade Plan

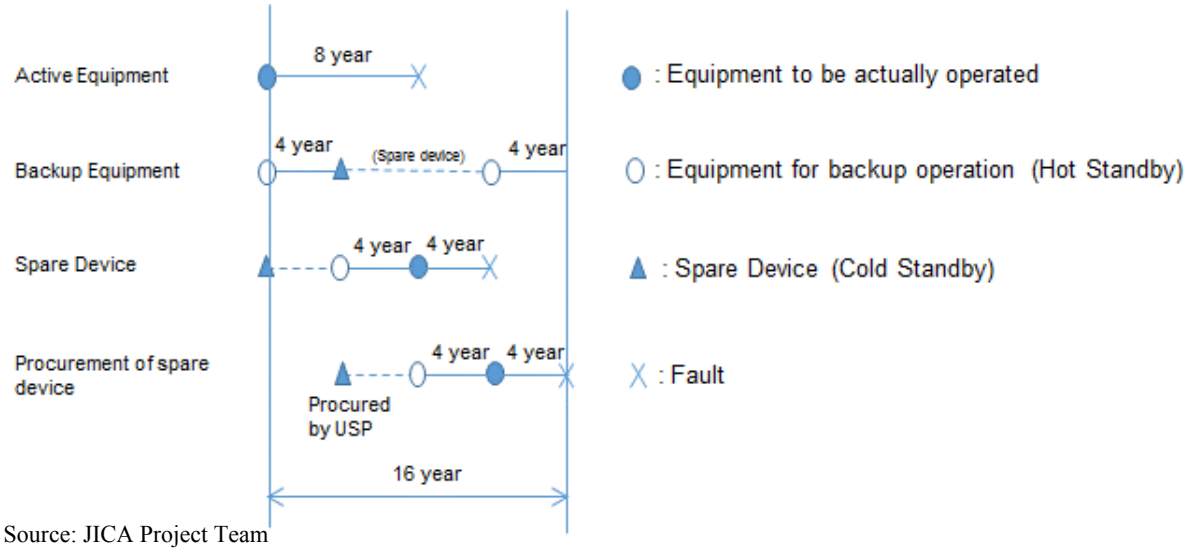
Period	Applicable devices and details of maintenance and upgrade
Every year	・ Parabolic antenna grease injection
When exhausted or damaged	・ Various fuses, fan units, dehydrator (dry air supply system) silica gel, feed horn cover
After 4 years	・ Replacement of block up converter backup equipment (hot standby) with a spare device (cold standby) provided by the Project ・ Procurement of spare device for block up converter (cold standby)
After 5 years	・ Parabolic antenna recoating
After 8 years	・ Replacing active block up converter of the Project with planned procured parts (cold standby) when active equipment breaks down, in order to create a hot standby condition
After 10 years	・ Upgrading baseband system, etc.
After 12 years	・ When the spare device for the Project used as active equipment for the block up converter is replaced eight years before breakdown (four years after the start of operations), replace the broken block up converter with the block up converter procured as backup equipment for the Project to maintain a hot standby condition

Source: JICA Project Team

The jack part of the elevation (EL) and azimuth (AZ) of the parabolic antenna is driven at a regular interval (several times per hour) by the automatic tracking function. For that reason, it will be necessary to inject grease into the driven parts about once a year. In addition, it is necessary to replace the fuses and fan units for each device when they are exhausted, damaged, etc.

Though block up converter and low noise converter are essential for satellite communication stations, these equipments cannot be procured in a short period as manufacturers produce after receiving order. In addition, because the block up converter will be continuously run with high output power, these will be degraded sooner than the other equipment. An active and backup (one to one) duplex structure will be adopted for block up converter system and low noise converter system in the Project in order to improve redundancy, and the systems will switch to the backup equipment if the active equipment breaks down while running. In addition, spare devices (cold standby) will be made available for the immediate replacement of the broken active equipment. In order to achieve USPNet management with a constant active and backup (one to one) duplex structure, it will be necessary to procure the preparatory spare devices when spare devices become active. In order to control the occurrence of unexpected equipment procurement costs when a breakdown occurs and conduct stable maintenance, it will be necessary to make preparations such as reserves for procurement costs for expensive block up converter and low noise converter.

In order to efficiently manage active equipment, backup equipment, and spare devices, it would be preferable to replace the hot standby backup equipment with a spare device (cold standby) four years after the start of operations. As a result, the period of operation of each equipment will stagger, which will make it possible to reduce the risk that both active equipment and backup equipment will malfunction at the same time. Figure 2-4-1 indicates management method for active equipment, backup equipment, and spare devices.



Source: JICA Project Team

Figure 2-4-1 Management Method for Active Equipment, Backup Equipment, and Spare Devices (16 years)

2-4-3 Routine Inspections

For system equipment that is run continuously such as satellite communication systems, the implementation of routine and periodic inspections are important for the stable and ongoing operations of systems over the long term.

Table 2-4-2 indicates the equipment inspection points and items required to carry out inspections (measuring devices, etc.). Note that the results of routine and periodic inspections shall be recorded in an inspection log to enable analysis thereafter.

Table 2-4-2 Equipment Inspection Points and Required Items (measuring devices, etc.)

Inspection type	Inspection points	Items required for inspection (measuring devices, etc.)
Routine inspections	・ Visual inspection of various meters and breakdown displays, etc.	・ Inspection log
	・ Signal measurement at specified points	・ Spectrum analyzer ・ Power meter ・ Frequency counter
Semi-annual inspection	・ Visual inspection of dehydrator (dry air supply system)	・ Inspection log
	・ Power supply, various voltage measurements	・ Tester
Annual inspection	・ Parabolic antenna characteristics	・ Spectrum analyzer
	・ Parabolic antenna grease injection	・ Grease injector
Five-year inspection	・ Parabolic antenna recoating	・ White coating for parabolic antenna

Source: JICA Project Team

2-4-4 Spare Parts

While spare parts for the main equipment will be procured in the Project, it will be necessary for USP to procure replacement spare parts in a systematic manner on the basis of the life span of the major

equipment. Table 2-4-3 indicates a breakdown of the spare parts that need to be procured. After the Project is completed, it will be necessary for the Fijian side to secure a budget for the costs of the required spare parts.

Table 2-4-3 Breakdown of Spare Parts

Spare span	Required spare parts	Quantity (items)
4 years	・Power Source Module for Baseband System	1
	・Fan Module for Baseband System	1
	・Fan Units for Various Pieces of Equipment	
	－ Beacon Receiver	1
	－ Receiving Frequency Converter	1
	－ Antenna Control Unit	1
	－ Active and Backup Block Up Converter System	2
8 years	Low Noise Converter	1
	Block Up Converter	1
	Outbound Line Card	1
	Inbound Line card	1

Source: JICA Project Team

2-4-5 Consumable Materials

Table 2-4-4 indicates the consumable required for maintenance and upkeep of the Equipment for the New Hub Station. After the Project is completed, it will be necessary for the Fijian side to prepare a budget for the costs of the required consumable materials and secure the budget in accordance with the plan.

Table 2-4-4 Consumable Materials Required for Maintenance and Upkeep

Item	5 years
	Quantity (items)
Grease unit for parabolic antenna	1
White coating for parabolic antenna	1

Source: JICA Project Team

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Estimation of Costs Borne by the Government of Japan

This section is closed due to confidentiality.

(2) Estimation of Costs Borne by the Government of Fiji

Table 2-5-1 Estimation of Costs Borne by the Government of Fiji

Item	Estimated Cost (FJD)	Remarks
① Bearing commissions to a bank in Japan for the banking services based upon B/A	17,500	・0.1% of E/N amount

Item	Estimated Cost (FJD)	Remarks
② Preparation of the communication satellite line	1,512,000	・communication satellite line Fee FJD 1,512,000/year ＊After 2022 the present communication satellite line fee becomes unnecessary FJD 1,725,800/year (C-Band FJD 1,360,000/year + Ku-band FJD 365,000/year).
③ Preparation of LAN network in the New Hub Station Building	100,000	・LAN cable: FJD 3,000 ・Cable laying: FJD 6,000 ・Other: FJD 1,000
④ Securing of power supply (Laying/connecting power cables from the existing distribution line to the New Hub Station Building and installation of an emergency generator).	200,000	・Power cable:FJD 5,000 ・kWh meter: FJD 500 ・Emergency generator: FJD 50,000 ・Installation work: FJD 120,000 ・Others: FJD 24,500
⑤ Installation of security fences and a gate for New Hub Station (around the new parabolic antenna)	20,000	・Fence: FJD 6,000 ・Support: FJD 4,500 ・Gate: FJD 2,000 ・Installation work: FJD 7,500
⑥ Replacement of Remote Station	7,053,830	・To be done using New Zealand Government fund (NZD 4,881,250≒FJD 7,053,830) and other sources
Total	**8,903,330**	

Source: JICA Project Team

(3) Estimate Conditions

1) Estimate timing: July 2017

2) Exchange rates: 1 USD ＝112.09 JPY
1 FJD ＝53.29 JPY

2-5-2 Operations, Maintenance and Management Costs

The cost required for sound operations, maintenance, and management (operations, maintenance, and management costs) of USPNet have been calculated as follows. Assuming that the Equipment of the Project is operated from 2019, the revenues and expenditures and reserves necessary for operations, maintenance, and management for 2019 to 2034 have been calculated.

(1) Revenues

Revenues have been calculated by preconditions as shown in Table 2-5-2.

Table 2-5-2 Revenues

Unit: FJD

Revenues		Budget Preconditions	Required Budget
1	Contributions from governments of 12 countries and regions	Assume that the income from governmental contributions in 2018 will be equal to the planned amount in 2017. The income from governmental contributions assumes that there will be no change in the amount of income until 2034 or thereafter.	38,420,000
2	Student tuition fees	Assume that the income from student tuition fees in 2018 will be equal to the planned amount in 2017. Also, taking into consideration the rate of increase of 96.0% (annual average of 19.2%) over the past five years (for the 2012 - 2017 plan), we assume that the annual growth rate will be 10.0%.	73,253,000
3	Development assistance from third countries	Assume that the income from development assistance in 2018 will be equal to the planned amount in 2017. The income from development assistance assumes that there will be no change in the amount of income until 2034 or thereafter.	46,687,000
4	Trading activities	Assume that the income of trading activities in 2018 will be equal to the planned amount in 2017. The income from trading activities assumes that there will be no change in the amount of income until 2034 or thereafter.	17,206,000
5	Consultancy incomes	Assume that the income from consultancy incomes in 2018 will be equal to the planned amount in 2017. The income from consultancy incomes assumes that there will be no change in the amount of income until 2034 or thereafter.	1,559,000
6	Other incomes	Assume that the income from other incomes in 2018 will be equal to the planned amount in 2017. The income from other incomes assumes that there will be no change in the amount of income until 2034 or thereafter.	9,052,790
7	Release of deferred revenue	Assume that the release of deferred revenue amount in 2018 will be equal to the planned amount in 2017. The income of release of deferred revenue assumes that there will be no change in the amount of income until 2034 or thereafter.	5,210,000
8	Interest	Assume that the interest income amount in 2018 will be equal to the planned amount in 2017. The income of interest income assumes that there will be no change in the amount of income until 2034 or thereafter.	700,000
9	Writing up of value of inventories	Assume that there will be no income from write up in value of inventories.	0
10	Realized exchange gains	Assume that there will be no income from realized exchange gain.	0
11	Unrealized exchange gain	Assume that there will be no income from unrealized exchange gain.	0

Source: JICA Project Team

(2) Expenditures

1) Operations Expenditures

Operations expenditures and budget preconditions are shown in Table 2-5-3.

Table 2-5-3 Operations Expenditures

Unit: FJD

Operations expenditures	Budget Preconditions	Required Budget
1 Staff costs	Assuming that the expenditure on staffing costs in 2018 will be equal to the planned amount in 2017. Also, taking into consideration the rate of increase of 23.9% (annual average of 4.8%) over the past five years (for the 2012 - 2017 plan), it is assumed that the annual growth rate is 4.8%.	83,540,000
2 Operating costs	Assuming that the expenditures on operating costs in 2018 will be equal to the planned amount in 2017. Also, taking into consideration the rate of increase of 14.6% (annual average of 2.9%) over the past five years (for the 2012 - 2017 plan), it is assumed that the annual growth rate is 3.0%. The satellite usage fee, electric bill and maintenance costs for the USPNet hub station are calculated separately.	91,707,000
3 Depreciation & amortization	Assuming that the expenditures on depreciation & amortization in 2018 will be equal to the planned amount in 2017. Also, taking into consideration the rate of increase of 43.6% (annual average of 8.7%) over the past five years (for the 2012 - 2017 plan), it is assumed that the annual growth rate is 8.8%.	13,317,000
4 Movement in impairment provisions	Assuming that the expenditures on movement in impairment provision amount in 2018 will be equal to the planned amount in 2017. The expenditures on movement in impairment provisions assumes that there will be no change in the expenditure amount until 2034 or thereafter.	1,497,000
5 Write down in value of inventories	Assuming that there will be no expenditures resulting from writing down of value of inventories.	0
6 Realized exchange losses	Assuming that there will be no expenditures resulting from realized exchange loss.	0
7 Unrealized exchange losses	Assuming that there will be no expenditures resulting from unrealized exchange loss.	0
8 Losses on disposal of assets	Assuming that there will be no expenditures resulting from losses on disposal assets.	0
9 Writing off of project debts	Assuming that there will be no expenditures resulting from writing off of project debts.	0

Source: JICA Project Team

2) Communication Satellite Usage Costs

Currently, USPNet uses 15 MHz of bandwidth on the C-band of the communication satellite NSS-9 and 5MHz of bandwidth on the Ku-band of the communication satellite IS-18, and the contract period is from September 2016 to August 2019. The changes in the communication satellite usage costs for the Project were calculated as follows, assuming that 20 MHz of the Ku-band will be used on the communication satellite JCSAT-2B from the start of operations in 2019. Table 2-5-4 shows the result of the calculation for the cost. Because the period of two years after the start of operations (November 2019 to October 2021) will overlap with the switchover period of remote stations, there will be overlapping communication satellite use costs during the period.

Table 2-5-4 Communication Satellite Usage Costs

Satellite	Current annual usage fees	Annual usage fees after the Project	Change (FJD)	Switchover period of remote station (Nov 2019 to Oct 2021)
a) Communication satellite NSS-9	This part is closed due to confidentiality			
b) Communication satellite IS-18				
c) Communication satellite JCSAT-2B	-	FJD 1,512,000 (= USD 720,000)	1,512,000 increase	FJD 1,512,000 (= USD 720,000)
Total	FJD 1,725,800 (= USD 822,000)	FJD 1,512,000 (= USD 720,000)	213,800 decrease	FJD 3,237,800 (= USD 1,542,000)

Source: JICA Project Team

3) Increase in Electricity Costs

While only one active equipment structure is currently being used, in the Project an active and backup duplex structure will be adopted. The increase in electricity usage from this change in the structure is estimated as shown in Table 2-5-5, and the increase in electricity costs were calculated on the basis of this estimate. Note that for the electricity costs, the USPNet hub station power consumption of approximately 3.5 kW for the current system and the New Hub Station power consumption of approximately 5.0 kW were calculated using a calculation method adopted from the Fiji Electricity Authority (FEA).

Table 2-5-5 Increase in Electricity Costs

Item	Current Hub Station	New Hub Station	Change
a) Power consumption	3.5 kW	5.0 kW	1.5 kW increase
b) Monthly power consumption	2,520 kWh	3,600 kWh	1,080 kWh increase
c) Monthly electricity costs	FJD 803	FJD 1,147	FJD 344 increase
d) Annual power consumption	30,240 kWh	43,200 kWh	12,960 kWh increase
e) Annual electricity costs	FJD 9,636	FJD 13,764	FJD 4,128 increase

Source: JICA Project Team

4) Maintenance and Management Costs (Consumables)

The driving parts of the parabolic antenna procured by the Project will be maintained in an appropriate condition by injecting grease into the movable parts (jacks) on a regular basis. In addition, regular application of a salt-resistant coating (epoxy-based) is important for the prevention of salt damage. The costs for the grease and salt-resistant coating (epoxy-based) have been calculated as shown in Table 2-5-6.

Table 2-5-6 Maintenance and Management Costs (consumable materials)

Item	Use frequency	Procurement cycle	Financing Cost/each time (FJD)
a) Grease injection	1 time/year	1 time/5 years	2,400
b) Salt-resistant coating	1 time/5 years	1 time/5 years	1,900
Total (every 5 years)			4,300

Source: JICA Project Team

5) Maintenance and Management Costs (Spare Parts and Upgrading Equipment)

Equipment procurement costs will be set aside as a reserve every year in an effort to equalize maintenance and management costs, since the costs for spare parts and upgrading equipment will be expensive.

The parts are on a four-year or eight-year replacement cycle, as indicated in Table 2-4-3. In addition, as indicated in Figure 2-4-1 block up converter equipment upgrade costs are expected to occur four years after the start of operations as a result of staggering the management period of active equipment and backup equipment. The cycles for part replacement and upgrading equipment and costs for the parts that will be replaced are shown in Table 2-5-7.

Table 2-5-7 Maintenance and Management Costs (Spare Parts and Upgrading Equipment)

Item	Replacement or Upgrade Cycle	Required Quantity	Unit Price (FJD)	Procurement Costs (FJD)
1. Power module for baseband system	4 years	1	19,000	19,000
2. Fan module for baseband system		1	6,000	6,000
3. Fan units for various pieces of equipment		5	2,000	10,000
4. Block up converter	8 years	1	920,000	920,000
5. Low noise converter		1	91,000	91,000
6. Outbound line card		1	199,000	199,000
7. Inbound line card		1	109,000	109,000
8. Baseband system	10 years	1	3,606,000	3,606,000
Total				4,960,000

Source: JICA Project Team

(3) Estimate Results

Table 2-5-8 indicates the projection of revenues and expenditures based on the above preconditions, revenues, and expenditures for the Project, starting in 2019 and ending in 2034, sixteen years later. It has been estimated that setting aside for the maintenance and management cost from 2019 after the start of operations of the Equipment of the Project will be possible to cover the parts replacement and upgrading system.

Table 2-5-8 The Projection of Revenues and Expenditures/Parts Replacement and System Upgrade Cycle

	Item	Passage year 2018	1 2019	2 2020	3 2021	4 2022	5 2023	6 2024	7 2025	8 2026	9 2027	10 2028	11 2029	12 2030	13 2031	14 2032	15 2033	16 2034
Total Income		192,087,790	199,413,090	207,470,920	216,334,533	226,084,508	236,809,479	248,606,948	261,584,164	275,859,101	291,561,533	308,834,207	327,834,148	348,734,084	371,724,014	397,012,936	424,830,750	455,430,347
Income	-Government Contributions	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000	38,420,000
	-Student Tuition Fees *1	73,253,000	80,578,300	88,636,130	97,499,743	107,249,717	117,974,689	129,772,158	142,749,374	157,024,311	172,726,742	189,999,416	208,999,358	229,899,294	252,889,223	278,178,146	305,995,960	336,595,556
	-Development Assistance	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000	46,687,000
	-Trading Activities	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000	17,206,000
	-Consultancy Income	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000	1,559,000
	-Other Incomes	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790	9,052,790
	-Release of Deferred Revenue	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000	5,210,000
	-Interest Income	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000
	-Write Up in Value of Inventories	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-Realized Exchange Gain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-Unrealized Exchange Gain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Expenditure		190,060,936.0	197,941,691.0	206,594,853.3	214,008,818.9	221,032,114.7	228,014,651.6	236,359,396.9	245,047,144.4	255,442,104.6	263,497,433.7	276,901,262.2	283,485,226.3	294,132,500.0	305,145,828.8	316,649,064.8	328,631,204.1	342,453,925.2
Expenditure	-Staff Costs *2	83,540,000	87,549,920	91,752,316	96,156,427	100,771,936	105,608,989	110,678,220	115,990,775	121,558,332	127,393,132	133,508,002	139,916,386	146,632,373	153,670,727	161,046,922	168,777,174	176,878,478
	-Operating Costs (Breakdown：Details are as follows)	91,706,936	94,405,875	98,711,752	101,575,269	103,835,255	105,831,460	108,956,201	112,179,115	116,852,715	118,917,904	126,049,968	126,067,085	129,838,324	133,651,651	137,615,428	141,702,418	147,257,288
	Satellite usage fee（NSS-9 & IS-18）	1,725,800	1,725,800	1,725,800	1,725,800	0	0	0	0	0	0	0	0	0	0	0	0	0
	Satellite usage fee（JCSAT-2B）	0	0	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000
	Electric Bill（Existing Hub Station）	9,636	9,636	9,636	9,636	0	0	0	0	0	0	0	0	0	0	0	0	0
	Electric Bill（New Hub Station）	0	0	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764
	Maintenance Cost（Consumable material）	0	0	0	0	0	4,300	0	0	0	0	4,300	0	0	0	0	4,300	0
	Maintenance Cost（Parts replacement）	0	0	0	0	1,046,000	0	0	0	1,354,000	0	3,606,000	0	35,000	0	0	0	1,354,000
	Other Operation Costs *3	89,971,500	92,670,439	95,450,552	98,314,069	101,263,491	104,301,396	107,430,437	110,653,351	113,972,951	117,392,140	120,913,904	124,541,321	128,277,560	132,125,887	136,089,664	140,172,354	144,377,524
	-Depreciation & Amortization *4	13,317,000	14,488,896	14,633,785	14,780,123	14,927,924	15,077,203	15,227,975	15,380,255	15,534,058	15,689,398	15,846,292	16,004,755	16,164,803	16,326,451	16,489,715	16,654,612	16,821,158
	-Movement in Impairment Provision	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000	1,497,000
	-Write Down in Value of Inventories	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-Realized Exchange Loss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-Unrealized Exchange Loss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-Loss on Disposal Assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-Write Off of Project Debts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surplus for the year (Income-Expenditure)		2,026,854	1,471,399	876,067	2,325,714	5,052,393	8,794,828	12,247,551	16,537,020	20,416,997	28,064,099	31,932,945	44,348,922	54,601,584	66,578,185	80,363,871	96,199,546	112,976,421
Deposit of the Maintenance Cost for the year *5		50,671	36,785	21,902	58,143	126,310	219,871	306,189	413,425	510,425	701,602	798,324	1,108,723	1,365,040	1,664,455	2,009,097	2,404,989	2,824,411
Total Deposit of the Maintenance Cost		50,671	87,456	109,358	167,501	293,811	513,681	819,870	1,233,296	1,743,721	2,445,323	3,243,647	4,352,370	5,717,409	7,381,864	9,390,961	11,795,949	14,620,360

【Note】 *1 Student Tuition Fees：Tuition Fee have increased by 96.0% (Annual average : 19.2%) over the past five (2012～2017) years. Tuition fee is calculated with annual growth rate as 10%.
*2 Staff Costs：Staff costs have increased by 23.9% (Annual average : 4.8%) over the past five (2012～2017) years. Staff cost is calculated with annual growth rate as 4.8%.
*3 Other Operation Costs：Other Operation Costs have increased by 14.6% (Annual average : 2.9%) over the past five (2012～2017) years. Other Operation cost is calculated with annual growth rate as 3.0%.
*4 Depreciation & Amortization：Depreciation & Amortization have increased by 43.6% (Annual average : 8.7%) over the past five (2012～2017) years. Depreciation & Amortization is calculated with annual growth rate as 8.8%.
*5 Deposit of the Maintenance Cost：When the Income and Expenditure amount is positive, 2.5% of the plus amount is deposit of the maintenance cost. And if the Income and Expenditure amount is negative, pay a minus amount from the deposit.

Item	Passage year 2018	1 2019	2 2020	3 2021	4 2022	5 2023	6 2024	7 2025	8 2026	9 2027	10 2028	11 2029	12 2030	13 2031	14 2032	15 2033	16 2034
Satellite usage fee																	
Satellite usage fee（NSS-9）	1,360,800	1,360,800	1,360,800	1,360,800	0	0	0	0	0	0	0	0	0	0	0	0	0
Satellite usage fee（IS-18）	365,000	365,000	365,000	365,000	0	0	0	0	0	0	0	0	0	0	0	0	0
Satellite usage fee（JCSAT-2B）	0	0	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000
Total Year	1,725,800	1,725,800	3,237,800	3,237,800	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000	1,512,000
Electric Bill																	
Electric Bill（Existing Hub Station）	9,636	9,636	9,636	9,636	0	0	0	0	0	0	0	0	0	0	0	0	0
Electric Bill（New Hub Station）	0	0	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764
Total Year	9,636	9,636	23,400	23,400	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764	13,764
Maintenance Cost (Consumable material)																	
Grease	0	0	0	0	0	2,400	0	0	0	0	2,400	0	0	0	0	2,400	0
Paint of salt resistance	0	0	0	0	0	1,900	0	0	0	0	1,900	0	0	0	0	1,900	0
Total Year	0	0	0	0	0	4,300	0	0	0	0	4,300	0	0	0	0	4,300	0
Maintenance Cost (Parts replacement)																	
Power module for Base Band System	0	0	0	0	19,000	0	0	0	19,000	0	0	0	19,000	0	0	0	19,000
Fan module for Base Band System	0	0	0	0	6,000	0	0	0	6,000	0	0	0	6,000	0	0	0	6,000
Fan Unit for the materials	0	0	0	0	10,000	0	0	0	10,000	0	0	0	10,000	0	0	0	10,000
Block Up converter	0	0	0	0	920,000	0	0	0	920,000	0	0	0	0	0	0	0	920,000
Low Noise Converter	0	0	0	0	91,000	0	0	0	91,000	0	0	0	0	0	0	0	91,000
Outbound Line card	0	0	0	0	0	0	0	0	199,000	0	0	0	0	0	0	0	199,000
Inbound Line card	0	0	0	0	0	0	0	0	109,000	0	0	0	0	0	0	0	109,000
Base Band System	0	0	0	0	0	0	0	0	0	0	3,606,000	0	0	0	0	0	0
Total Year	0	0	0	0	1,046,000	0	0	0	1,354,000	0	3,606,000	0	35,000	0	0	0	1,354,000

Source: JICA Project Team

CHAPTER 3 BACKGROUND OF THE SUSPENSION OF THE PROJECT

CHAPTER 3 BACKGROUND OF THE SUSPENSION OF THE PROJECT

3-1 Situation as of the 1st Field Survey

3-1-1 Confirmation of Work Demarcation Regarding USPNet with the Delegation from the Government of New Zealand (20th June, 2017)

JICA Project Team discussed with the delegation from the Government of New Zealand (the Ministry of Foreign Affairs and Trade and the Consulate of New Zealand in Fiji) and confirmed the content of the Activity Design Document which USP is implementing with the assistance of the Government of New Zealand. In addition, it was confirmed that USP and the Japanese side would go ahead the work relating to USPNet on the basis of the demarcation as shown in Table 3-1-1.

Table 3-1-1 Demarcation of works between Japanese side and USP side

No.	Work item	Japanese side	USP side (using funds from New Zealand)	Remark
1	Repair of existing C-band antenna		○	Short-term undertaking
2	Planning for updating existing hub station	○		Medium- to long-term undertaking
3	Update and repair of remote stations in member countries and regions of USP		○	

Source: JICA Project Team

3-1-2 Confirmation of Request by USP (23rd June, 2017)

JICA Project Team discussed with USP and confirmed that the requested items in the Project are the New Hub Station Building, equipment for the hub station, and soft components relating to operation and maintenance of the equipment. In addition, it was also confirmed that USP has the desire to operate USPNet using multiple hub stations (secondary Hub Station) in order to ensure redundancy in the system. The details of this discussion are given in the minutes of the discussion (M/D).

In addition, JICA Project Team suggested the future grand design of USPNet, aiming at effective usage of frequency bandwidth by integrating communication satellites currently used in USPNet into one Ku-band system, reduction of costs for USPNet, duplication of hub stations and the like. Table 3-1-2 shows the intention of USP to suggested points by JICA Project Team.

Table 3-1-2 Suggestion for improvement of USPNet

No.	Suggestion	Merit	Intention of USP
1	Integration of communication satellite of USPNet into one system	Effective usage of frequency bandwidth by changing the operation of USPNet from using two satellites (C-band and Ku-band) into one satellite (Ku-band), which will lead to reduction of	In addition to the merit mentioned in the left, Ku-band can reduce the size of antennas at remote stations, which will enable students, who cannot commute to

No.	Suggestion	Merit	Intention of USP
		operation cost.	campuses/centres easily, to take distance learning classes at their houses by installing small-sized antennas at their houses.
2	Duplication of hub stations	Dispersing the risk of suffering damage from disasters such as cyclones and earthquakes by deploying the secondary Hub Station at another distant campus. It is also expected that the link availability will be improved because USPNet can continue its operation during maintenance of hub stations.	USP has been considering duplication of hub stations of USPNet, by establishing the secondary Hub Station in either Tonga, Vanuatu, Marshall Islands or Samoa which are connected with Fiji via optical submarine cables.
3	Future grand design for USPNet	Enabling overall design aiming at enlarging capacity for contents of USPNet as a medium- to long-term undertaking, in consideration with increase of the number of students in future.	USP hopes that Japanese side will prepare overall design of USPNet, same as 2000 when USPNet was introduced.

Source: JICA Project Team

3-1-3 Confirmation of Technical Specifications of the Equipment to be Procured in the Project (3rd July, 2017)

JICA Project Team prepared the Field Report (Appendix-8) to confirm the technical specifications of the Equipment to be procured in the Project and explained these to the ITS group, which is the contact group for technical coordination at USP. Then the ITS group agreed that JICA Project Team will prepare the cost estimation of the Project and the draft specification of the Equipment in accordance with the Field Report.

3-2 Request from Fiji as of the 2nd Field Survey

3-2-1 Explanation on Contents of the Project from JICA Project Team to USP (5th December, 2017)

JICA Project Team and Vice-Chancellor & President of USP (hereinafter referred to as "VC") confirmed issues regarding USPNet such as its cost, additional introduction of a new distance learning programme, deterioration of the equipment, etc. In order to solve the issues, JICA Project Team also explained the basic conception to integrate the system of USPNet into the type of using only Ku-band from that of currently using both C-band and Ku-band together. The grand design of USPNet was indicated, including ①that the equipment to be procured at hub stations will be for Ku-band, ②plan for replacement from existing equipment of C-band into that of Ku-band, and ③conception on duplication of hub stations. However JICA Project team did not obtain an agreement of VC at this stage.

3-2-2 Request from USP (6th December, 2017)

During hearing from ITS group, it became clear that explanation of the technical specifications of the Equipment to be procured in the Project had not been made by the ITS group to VC, the person

responsible at USP. In addition, the ITS group requested preparation of a draft of the technical specifications of the Equipment, with particular focus on the details of the frequency bandwidth, from JICA Project Team, because it was necessary for USP to go through a process of suggesting multiple proposals to VC, who is the final decision maker, and asking for opinions.

3-2-3 Explanation by JICA Project Team to USP of the Technical Specifications of the Equipment (7th December, 2017)

JICA Project Team gave explanations in multiple drafts of the technical specifications of the New Hub Station (Appendix-9), including explanations on the frequency bandwidth, to the Head of the Science and Technology Department and the ITS Group, because VC was absent due to a business trip. As shown in Table 3-2-1, in case communication satellites of USPNet consist of only those for Ku-band, there will be merits such as fewer costs compared with the current system, expansion of frequency bandwidth available for communication, reduction of size of antennas at remote stations, longer life expectancy of communication satellites and the like. JICA Project Team explained those merits at the meeting with the Fijian side, and got the understanding of attendees.

Table 3-2-1 Comparison between the case of using Ku-band / C-band together and the case using only Ku-band

Compared points	Using C-band and Ku-band together (same as current operation)		Using only Ku-band	Remark
Number of satellite in usage	2		1	
Satellite communication fee per year	C-band	This part is closed due to confidentiality	1,512,000 FJD (- 213,800 FJD)	It is expected that the communication fee of approximately 11.4 million yen (213,800 FJD, 1FJD = 53.29 yen) will be reduced. In addition, maintenance and management fee on regular inspection, equipment for painting and the like will be cut, because the number of satellites will be reduced from 2 to 1.
	Ku-band			
	Total	1,725,800 FJD		
Frequency bandwidth	C-band	15 MHz	20 MHz	As shown in No. 1 of Table 3-1-2, frequency bandwidth can be used effectively in case of adopting only Ku-band. It will be possible to introduce video contents which require high-speed data communication.
	Ku-band	5 MHz		
Link availability (Rate of period per year keeping provision of service)	C-band	99.98 % - 99.99 %	99.72 - 99.97 %	Performance of Ku-band was supposed to be worse in stormy conditions, however it is possible to secure the same availability as the C-band by increasing the power of radio waves from the satellite, increasing the aperture of the antenna at the hub station (from 4.5 m to 7 m class), and so on.
	Ku-band	73.39 % - 99.74 %		
Diameter of antennas at remote stations	C-band	4.5 m (campuses) - 1.8 m (centres)	4.5 m (campuses) - 1.8 m (centres) - 1.0 m (housing)	It will become easier to promote for reduction of difference in education quality in the Pacific region, along with the intention of ITS group, as shown in No. 1 of Table 3-1-2.
	Ku-band			

Compared points	Using C-band and Ku-band together (same as current operation)		Using only Ku-band	Remark
Satellite in usage	C-band	NSS-9 and JCSAT-2B (C)	JCSAT-2B (Ku) IS-18	Estimated year that operation of communication satellites will stop are as follows. (Life expectancy of satellites is generally 15 years) NSS-9: 2024 IS-18: 2026 JCSAT-2B: 2031
	Ku-band	IS-18 and JCSAT-2B (Ku)		

Source: JICA Project Team

3-3 Situation after the 2nd Field Survey

3-3-1 Inquiry from USP to JICA Project Team about the Technical Specifications (20th December, 2017)

JICA Project Team received an inquiry via e-mail from ITS group which said, “After the equipment of Ku-band is introduced at hub stations, will it be possible to replace them with those of C-band?”

JICA Project Team answered, “That kind of refurbishment will not be practical from the aspect of its cost, even though it is theoretically possible”. (22nd December, 2017)

3-3-2 Discussion between USP and JICA Fiji Office (5th January, 2018)

Regarding the Equipment to be procured in the Project, USP showed their intention to select the C-band on the basis of the result of consideration in the university. The background of selecting C-band were stated; ①as a rule of thumb, there remains concern about whether Ku-band will enable the system to operate stably under bad weather condition, ②there will be more alternatives in C-band because multiple communication satellites are currently available, ③update of antennas for C-band at remote stations (campuses) are already being proceeded with the assistance of the Government of New Zealand, etc.

In addition, USP also showed their idea to have discussions with telecommunication providers (Telecom Fiji, Telecom Vanuatu and the like), aiming at ensuring redundancy of USPNet using optical submarine cables as well as communication satellites.

3-3-3 Additional Information on USPNet (13th February, 2018)

USP submitted JICA the revised minutes of meeting mentioned in 3-3-2. As of this timing, JICA Project Team newly recognized the situation on the Fijian side; update of antennas for C-band, discussions between USP and the telecommunication providers and the like, as stated in 3-3-2.

3-3-4 Consideration in JICA (16th February, 2018)

JICA examined the sequence of the events through the Project from the 1st field survey for outline design (OD) to the latest, and confirmed again that the specification of the system suggested by JICA

Project Team is rational, as shown in Table 3-2-1.

3-3-5 Implication for Suspension of the Project from the Fijian side (20th March, 2018)

At the interview of USP and JICA Fiji Office, USP told that it was necessary to consider the future way of USPNet including the use of not only communication satellite network but also optical submarine cables, which are proceeded to be under installation recently in the Pacific Island countries, therefore USP was considering the possibility of suspension of the Project.

3-3-6 Response of the Japanese Side on the Basis of the Background up to the Present (27th March, 2018 to 26th April, 2018)

(1) After the result of 3-3-5, on the basis of the background up to the present, the Ministry of Foreign Affairs of Japan and JICA held a meeting to consider the policy for dealing with the Project. It was judged that continuing cooperation for C-band would be difficult due to the following reasons. (27th March, 2018)

- It is scheduled to repair the existing C-band antenna in Laucala campus with the assistance of the Government of New Zealand. Installation of C-band antenna with the assistance of Japan will be duplication with that of New Zealand and thus excessive investment.
- Functions of C-band to be improved are less compared with those of Ku-band, and thus effectiveness on development is expected to be low.
- Cost for the survey on introducing Ku-band has already been spent so far, therefore it will be a considerable additional cost by changing from Ku-band to C-band.

(2) JICA headquarters explained the policy to suspend the field survey in the Project to the Ministry of Foreign Affairs of Japan and they accepted it. (19th April, 2018)

(3) An official letter regarding the suspension of the Project was issued from JICA headquarters to USP. (19th April, 2018)

(4) JICA Fiji Office visited USP and explained the reason why the field survey of the Project was suspended after handling the letter as a result of discussion between the Ministry of Foreign Affairs of Japan and JICA headquarters. USP acknowledged this and expressed that USP would like to continue positive discussions toward building a new cooperative relationship in the future. (26th April, 2018)

Appendices

Appendix 1 Member List of JICA Project Team

1. Member List of JICA Project Team

JICA Project Team (1st Field Survey)

Name	Work Assignment	Position
Tomoyuki NAITO	Leader	Senior Advisor ICT and Development Japan International Cooperation Agency
Masao SHINO	Project Coordinator	Deputy Director Planning and Coordination Division & Team 1 Transportation and ICT Group Infrastructure and Peacebuilding Department Japan International Cooperation Agency
Kiyofusa TANAKA	Chief Consultant	Yachiyo Engineering Co., Ltd.
Yosuke IKEDA	Sub Chief Consultant	Yachiyo Engineering Co., Ltd.
Hiroshi SASANUMA	Satellite Communication	Yachiyo Engineering Co., Ltd.
Kazuyoshi FUKUSHIMA	Operation and Maintenance Planning	Yachiyo Engineering Co., Ltd.
Tetsuhiro YAMASHITA	Antenna Foundation	Yachiyo Engineering Co., Ltd.

JICA Project Team (2nd Field Survey)

Name	Position	Agency / Company
Tomoyuki NAITO	Leader	Senior Advisor ICT and Development Japan International Cooperation Agency
Kiyofusa TANAKA	Chief Consultant	Yachiyo Engineering Co., Ltd.
Yosuke IKEDA	Sub Chief Consultant	Yachiyo Engineering Co., Ltd.
Hiroshi SASANUMA	Satellite Communication	Yachiyo Engineering Co., Ltd.

Appendix 2 Study Schedule

THE PROJECT FOR ENHANCEMENT OF USPNET COMMUNICATION SYSTEM
Schedule for the 1st Field Survey

No.	date	day	Survey Content							Stay at
			JICA Mr. Tomoyuki NAITO	JICA Mr. Masao SHINO	yec Mr. Kiyofusa TANAKA	yec Mr. Yosuke IKEDA	yec Mr. Hiroshi SASANUMA	yec Mr. Kazuyoshi FUKUSHIMA	yec Mr. Tetsuhiro YAMASHITA	
	person in charge		Leader	Project Coordinator	Chief Consultant /Satellite Communication Planning	Sub Chief Consultant /Cost Estimation	Equipment Planning (Satellite Communication System)	Operation and maintenance Planning	Construction Planning / Foundation of Parabola Antenna	
	Number of days				13	24	19	19	24	
1	12-Jun	Mon			Trip [Haneda→Sydney +1]					on Flight(Consultant)
2	13-Jun	Tue			Trip [→Sydney→Nadi→Suva]					Suva
3	14-Jun	Wed			・Meeting with JICA Fiji office ・Meeting with USP(University of the South Pacific) ・Internal Meeting					Suva
4	15-Jun	Thu			・Meeting with USP(University of the South Pacific) ・Site Survey (Existing Satellite Telecommunication Equipment) ・Meeting with ADB ・Internal Meeting					Suva
5	16-Jun	Fri	Trip [Geneva→London→Hong Kong +1]		・Meeting with USP ・Site Survey (Existing Satellite tracking Equipment) ・Meeting with ADB ・Internal Meeting					on Flight (Mr. NAITO) and Suva
6	17-Jun	Sat	Trip [→Hong Kong→Nadi +1]	Trip [Haneda→Sydney +1]	・Internal Meeting ・Survey of Local Procurement.					on Flight (Mr. NAITO & Mr. SHINO) and Suva
7	18-Jun	Sun	Trip [→Nadi→Suva]	Trip [→Sydney→Nadi→Suva]	・Internal Meeting ・Survey of Local Procurement.					Suva
8	19-Jun	Mon	・Meeting with USP about M/D, operation and mainetnance scheme, personnel, finance and budget, donation by other donor, confirmation of related laws and standard for the project. ・Meeting with Ministry of Education							Suva
9	20-Jun	Tue	・Meeting with USP about M/D, operation and mainetnance scheme, personnel, finance and budget, donation by other donor, confirmation of related laws and standard for the project. ・Meeting with Ministry of Finance ・Meeting with New Zealand High Commission							Suva
10	21-Jun	Wed	・Conclude M/D (Sign) ・Report to EOJ and JICA Fiji Office				・Meeting with TAF(Telecommunication Authority of Fiji)		・Meeting with Local Survey Company	Suva
11	22-Jun	Thu	＊In charge of other mission	Trip [Suva→Nandi→Sydney→Haneda +1]	・Meeting with USP ・Preparation of Field Report	・Reserch for TAX exemption ・Market research and collect of Quotation	・Meeting with Australian High Commission		・Meeting with USP and Site Survey ・Market research and collect of Quotation	on Flight(Mr. SHINO) and Suva
12	23-Jun	Fri	＊In charge of other mission	Trip [→Haneda]	・Meeting with USP ・Preparation of Field Report	・Meeting with USP ・Reserch of Statistical Data ・Preparation of Field Report	・Meeting with Ministry of Communication ・Preparation of Field Report		・Meeting with USP ・Reserch of Meteorological data ・Preparation of Field Report	Suva
13	24-Jun	Sat	Trip [Suva→Nandi→Sydney→Haneda +1]		・Market research and collect of Quotation ・Preparation of Field Report	・Market research and collect of Quotation ・Preparation of Field Report	・Market research and collect of Quotation ・Preparation of Field Report	・Market research and collect of Quotation ・Preparation of Field Report	・Market research and collect of Quotation ・Preparation of Field Report	on Flight(Mr. NAITO) and Suva
14	25-Jun	Sun	Trip [→Haneda]		Trip [Suva→Nandi→Sydney→Haneda +1]	・Arrange of data ・Preparation of Field Report	・Arrange of data ・Preparation of Field Report	・Arrange of data ・Preparation of Field Report	・Arrange of data ・Preparation of Field Report	on Flight(Mr. Tanaka) and Suva
15	26-Jun	Mon			Trip [→Haneda]	・Confirmation of Field Report and Sign with Ministry of Finance and USP	・Site Survey (Existing Link budget) ・Preparation of Survey Report	・Hearing of ATH and PITA ・Preparation of Survey Report	・Meeting with Local Survey Company ・Supervise for Soil Investigation	Suva
16	27-Jun	Tue				・Preparation of Survey Report	・Meeting with USP ・Preparation of Survey Report	・Hearing of TFL, FINTEL, Digicel ・Preparation of Survey Report	・Meeting with Local Survey Company ・Supervise for Soil Investigation	Suva
17	28-Jun	Wed				・Meeting with USP ・Preparation of Survey Report	・Meeting with USP ・Preparation of Survey Report	・Meeting with USP ・Preparation of Survey Report	・Meeting with USP and Local Survey Company ・Supervise for Topographic Survey	Suva
18	29-Jun	Thu				・Survey of Local Construction Company ・Preparation of Survey Report	Trip [Suva→Nandi→Sydney→Haneda +1]		・Meeting with Local Survey Company ・Comfermation of Tentative Survey Report	on Flight(Mr. SASANUMA & Mr. FUKUSHIMA) and Suva
19	30-Jun	Fri				・Survey of Local Transportation Company ・Preparation of Survey Report	Trip [→Haneda]		・Meeting with Local Survey Company ・Comfermation of Tentative Survey Report	Suva
20	1-Jul	Sat				・Market research and collect of Quotation ・Arrange of Data			・Market research and collect of Quotation ・Arrange of Data	Suva
21	2-Jul	Sun				・Market research and collect of Quotation ・Arrange of Data			・Market research and collect of Quotation ・Arrange of Data	Suva
22	3-Jul	Mon				・Meeting with USP ・Report to EOJ ・Report to JICA Fiji Office			・Meeting with USP ・Report to EOJ ・Report to JICA Fiji Office	Suva
23	4-Jul	Tue				Trip [Suva→Nandi→Sydney→Haneda +1]			Trip [Suva→Nandi→Sydney→Haneda +1]	on Flight(Mr. IKEDA & Mr. YAMASHITA)
24	5-Jul	Wed				Trip [→Haneda]			Trip [→Haneda]	

THE PROJECT FOR ENHANCEMENT OF USPNET COMMUNICATION SYSTEM

Schedule for the 2nd Field Survey

No.	date	day	Survey Content				Stay at
			JICA Mr. Tomoyuki NAITO	yec Mr. Kiyofusa TANAKA	yec Mr. Yosuke IKEDA	yec Mr. Hiroshi SASANUMA	
person in charge			Leader	Chief Consultant /Satellite Communication Planning	Sub Chief Consultant /Cost Estimation	Equipment Planning (Satellite Communication System)	
Number of days			7	10	9	10	
1	3-Dec	Sun	Trip [Haneda→Sydney +1]	Trip [Narita→Sydney +1]			on Flight
2	4-Dec	Mon	Trip [Sydney→Suva]			Trip [Sydney→Suva]	Suva (Naito, Tanaka and Sasanuma)/Sydney (Ikeda)
3	5-Dec	Tue	・Discussion with USP (Confirmation of Project component, Specification of the Equipment, etc.) ・Discussion with New Zealand High Commission (Confirmation of the progress of assistance by NZ regarding USPNet, etc.)		Trip [Sydney→Nadi→Suva]	Same as Leader	Suva
4	6-Dec	Wed	・Meeting with USP (Confirmation of the frequency band selection for New Hub Station) ・Field Survey				Suva
5	7-Dec	Thu	・Meeting with USP (Explanation of Comparison between C band and Ku band) ・Report to Embassy of Japan in Fiji and JICA Fiji Office				Suva
6	8-Dec	Fri	Trip [Suva→Sydney]	・Meeting with USP (Confirmation of the data traffic of services and contents in each C band and Ku band in the current USPNet, Interview regarding distance learning, etc.) ・Field Survey			Suva
7	9-Dec	Sat	Trip [Sydney→Haneda]	・Internal Meeting ・Arrange of Data			Sydney (Naito)/Suva (Consultant)
8	10-Dec	Sun		・Internal Meeting ・Arrange of Data			Suva (Consultant)
9	11-Dec	Mon		・Meeting with USP (Confirmation of the data traffic of services and contents in each C band and Ku band in the current USPNet, etc.) Trip [Suva→Nadi→Sydney]			Sydney (Consultant)
10	12-Dec	Tue		Trip [Sydney→Narita]			Narita

Appendix 3 List of Parties Concerned in the Recipient Country

3. List of Parties Concerned in the Recipient Country

Name and Affiliation	Position
Ministry of Education, Heritage & Arts	
Serupepeli Udre	Director Assets Manager
David Ali	Executive Officer
Ministry of Economy	
Nilesh Prakash	Director Climate Change
The University of the South Pacific (USP)	
Rajesh Chandra	Vice-Chancellor and President
Derrick Armstrong	Duputy Vice-Chancellor
Iresh Ssil Lal	Manager, Development, Marketing, Communications and Alumni（DMCA）
Jaindra K. Karan	Director
Kisione Wesley Finau	Director, Information Technology Service（ITS）
Fereti Atalifo	Deputy Director, Information Technology Service（ITS）
Marika Qalomai	Information Technology Service（ITS）
Anjeda joklan	Information Technology Service（ITS）
Fiji Meteorological Service (FMS)	
Marica Ratuki	Senior Engineer (Nadi Met. Office)
Arieta Daphne	Officer in Charge (Nadi Met. Office)
New Zealand High Commission	
Jonathan Rowe	Counsellor - Development
Surava Elaisa	Development Programme Coordinator
New Zealand Foreign Affairs & Trade	
Paul Seaden	Principal Development Manager, ICT Sustainable Economic Development Division
Tim Stewardson	Development Officer Sustainable Economic Development Division

Embassy of Japan in Fiji

Tsuguyoshi Hada	Counsellor & Deputy Chief of Mission
Tomoaki Miyamoto	First Secretary

JICA Fiji Office

Hiroyuki Sawada	Resident Representative
Shinya Tamio	Deputy Director
Shunichiro Ikeda	Assistant Resident Representative
Kozue Shimizu	Assistant Resident Representative
Shin Suto	Assistant Resident Representative
Nila Prasad	Program Officer
Frances Tavaiqia	Program Officer

JICA Tokyo

Yuji Ueno	Pacific and Southeast Asia Division 6, Southeast Asia and Pacific Department

Appendix 4 Minutes of Discussions

Minutes of Discussions
on the Preparatory Survey for the Project for
the Enhancement of USPNet Communication System

In response to the request from the Government of the Republic of Fiji (hereinafter referred to as "the Republic of Fiji"), Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team") of the Project for **the Enhancement of USP Net Communication System** (hereinafter referred to as "the Project") to the Republic of Fiji, headed by Tomoyuki NAITO, Senior Advisor, JICA, from June 18 to July 4, 2017. The Team held a series of discussions with the officials of the Government of the Republic of Fiji and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Suva, June 23, 2017

Tomoyuki NAITO
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Professor Derrick Armstrong
Deputy Vice Chancellor
The University of the South Pacific

Iowane Tiko
Permanent Secretary
Ministry of Education, Heritage & Arts
Republic of the Fiji

ATTACHMENT

1. Objective of the Project

The objective of the Project is to enhance the function of distance learning network in USPNet through updating the aging satellite communication system in USPNet, thereby contribute to provide and maintain the distance learning services for University of South Pacific (USP)'s member countries.

2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as "the Preparatory Survey for the Project for **the Enhancement of USPNet Communication System**".

3. Project site

Both sides confirmed that the site of the Project is in Suva,the Republic of Fiji, which is shown in Annex 1.

4. Responsible authority for the Project

Both sides confirmed the authorities responsible for the Project are as follows:

4-1. The University of the South Pacific will be the executing organization for the Project (hereinafter referred to as "the Executing Organization"). The Executing Organization shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant authorities properly and on time. The organization chart is shown in Annex 2.

4-2. The Team confirmed that the Ministry of Education, Heritage & Arts shall be responsible for supervising the Executing Organization on behalf of the Government of the Republic of Fiji as the Line Ministry.

5. Items requested by the Government of the Republic of Fiji

5-1. As a result of discussions, both sides confirmed that the items requested by the Government of the Republic of Fiji are as follows:

- Antenna & Related Radio Frequency (RF) Systems
- iDirect Baseband Hub System
- New Hub Earth Station Building and its necessary supplies, and;
- Other related necessary technical assistances.

5-2. JICA will assess the feasibility of the above requested items through the survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan based on the reported findings.

6. Procedures and Basic Principles of Japanese Grant

6-1. The Republic of Fiji agreed that the procedures and basic principles of Japanese Grant as described in Annex 3 shall be applied to the Project.

As for the monitoring of the implementation of the Project, JICA requires the Republic of Fiji to submit the Project Monitoring Report, the form of which is attached as Annex 4.

6-2. The Republic of Fiji agreed to take the necessary measures, as described in Annex 5, for smooth implementation of the Project. The contents of the Annex 5 will be elaborated and refined during the Preparatory Survey and be agreed in the mission dispatched for explanation of the Draft Preparatory Survey Report.

The contents of Annex 5 will be updated as the Preparatory Survey progresses, and eventually, will be used as an attachment to the Grant Agreement.

7. Schedule of the Survey

7-1. The Team will proceed with further survey in the Republic of Fiji until July 4 2017.

7-2. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to the Republic of Fiji in order to explain its contents around February 2018.

7-3. If the contents of the draft Preparatory Survey Report is accepted and the undertakings for the Project are fully agreed by the Republic of Fiji, JICA will finalize the Preparatory Survey Report and send it to the Republic of Fiji around May 2018.

7-4. The above schedule is tentative and subject to change.

8. Environmental and Social Considerations

8-1. The Republic of Fiji confirmed to give due environmental and social considerations before and during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010).

8-2. The Executing Organization shall reconfirm the necessary procedures concerning the environmental assessment (including stakeholder meetings, Environmental Impact Assessment(EIA) /Initial Environmental Examination (IEE) and information disclosure, etc.) and share the information with the Team before 4th July 2017.

8-3 If the EIA/IEE process are necessary in the Republic of Fiji, the Government of the Republic of Fiji will conduct the necessary procedures concerning the environmental assessment (including stakeholder meetings, EIA /IEE and information disclosure, etc.) and make EIA/IEE report of the Project. The EIA/IEE approval shall be received from the responsible authorities and submitted to JICA by February 2018.

9. Major Undertakings to be taken by the Government of the Republic of Fiji

The Republic of Fiji shall, at its own expenses, provide the Team with the following items

in cooperation with organizations concerned:

(1) Security-related information as well as measures to ensure the safety of the Team members;
(2) Information as well as support in obtaining medical service;
(3) Data and information related to the Preparatory Survey;
(4) Counterpart personnel;
(5) Suitable office space with necessary equipment and services (connection of internet service, etc.);
(6) Credentials or identification cards;
(7) Entry permits necessary for the survey team members to conduct field surveys; and
(8) Support in obtaining other privileges and benefits if necessary.

10. Other Relevant Issues

10-1. Agreed Fundamentals among the Government of New Zealand, the Executing Organization and JICA

The Team had coordination discussions with both the representative from the Government of New Zealand and the Executing Organization as for the requested rehabilitation of existing C-band antenna in Suva Laucala campus at the Executing Organization as well as the development of USPNet infrastructure upgrade. As a result of the discussion, three parties mutually agreed following fundamentals;

(1) The requested rehabilitation of existing C-band antenna in Suva Laucala campus will be taken care by the New Zealand's grant contribution recently officially committed to the Executing Organization. Accordingly, the Executing Organization will hire consultant firm and contractor to implement the urgently required rehabilitation by using the contribution from the Government of New Zealand. The Team agreed to proactively share the holding data and information related to the urgently required rehabilitation work to both the Government of New Zealand and the Executing Organization in order to support the smooth implementation.

(2) The development of USPNet infrastructure upgrade should be implemented primarily by the above mentioned three parties through fully coordinated manner, by using both the Activity Design Document prepared for the contribution of the Government of New Zealand titled "USPNet infrastructure Upgrade" and the Project's preparatory survey.

(3) The Govermnent of New Zealand commits to share information with JICA in a free and open manner in order that the development of USPNet infrastructure upgrade is

successful for all parties.

10-2. HUB Redundancy on USPNet Infrastructure

The Team confirmed that the HUB redundancy on USPNet infrastructure is crucially important to secure the continuous connectivity for stable distance learning service provision to beneficiaries in member countries, though the series of technical discussion with the Executing Organization. While the importance is fully understandable, the Team pointed out about the necessary official grant request procedure from the country outside the Republic of Fiji to meet with the Japan's bilateral grant aid financial cooperation scheme. In order to support the redundancy idea, the Team will further discuss and consider the necessary procedure and technical investigation with the Executing Organization.

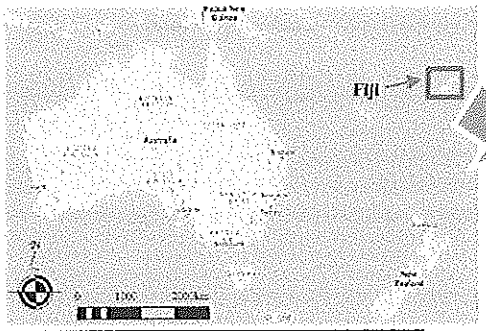
10-3. The Concerns expressed by the Executing Organization

The Executing Organization notes with concern the shift in timing of a decision on the Project by the Government of Japan. The Executing Organization sees a big risk to the Project with this shift of timelines. Initially, the intended decision date was to be July 2017. This was extended to May 2018. Nearly a year of delay adds to the potential risks to the Executing Organization's core activity. The Executing Organization needs certainty that the May 2018 decision date will not be delayed further, thus increasing the risk that the Executing Organization faces

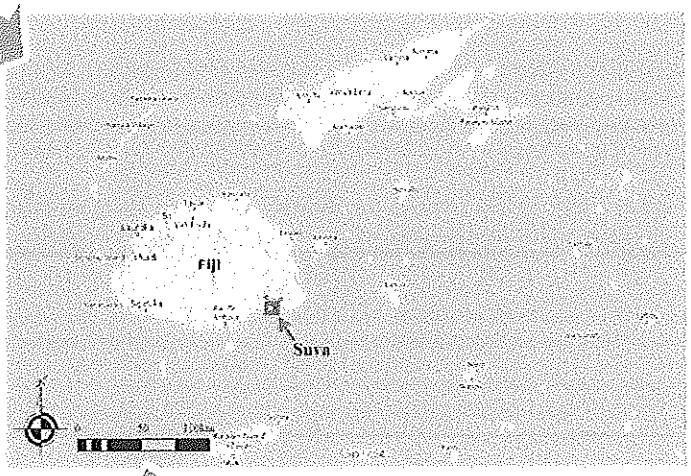
10-4. Review of the Minutes of Discussions

The Executing Organization notes that the roles indicated for the Government of Fiji is JICA's understanding of these during their meeting with the Government of Fiji. If the Government of Fiji disagrees to any sections where it has been mentioned, three parties, the Government of Fiji, the Executing Organization and JICA, reserves the right to review the Minutes of Discussions as appropriate.

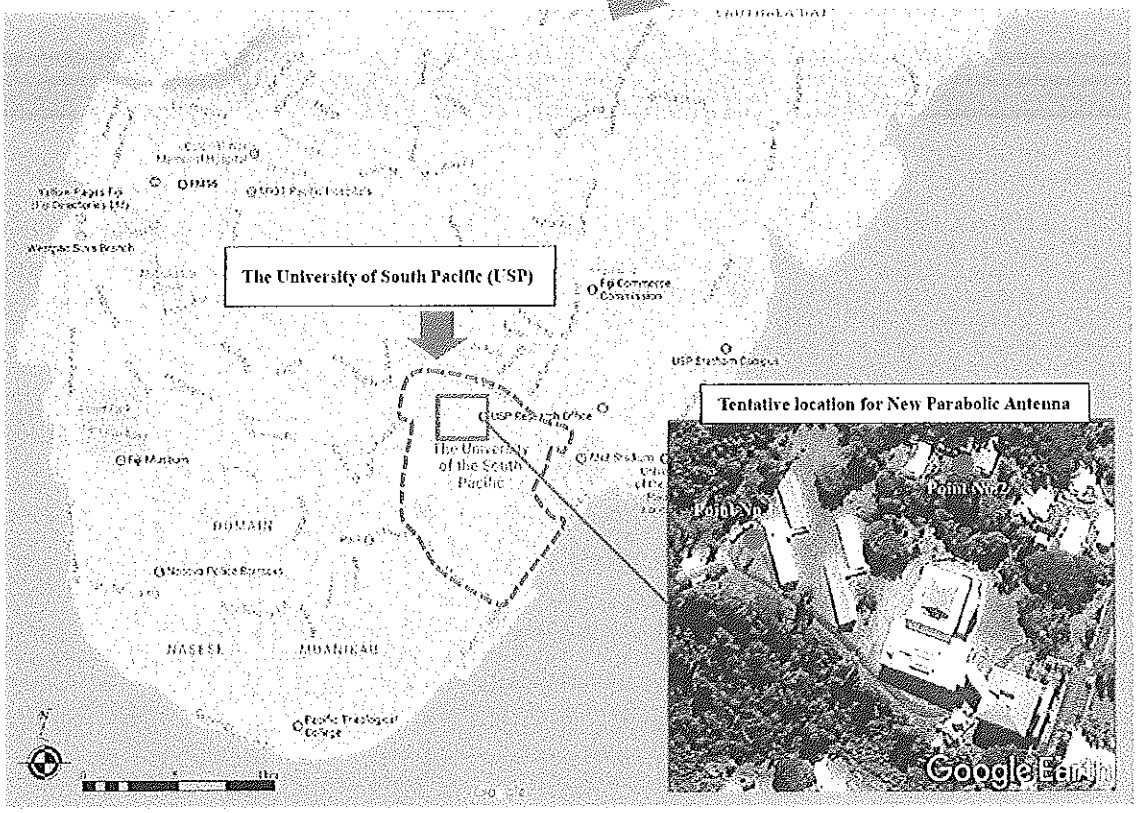
Annex 1 Project Site
Annex 2 Organization Chart
Annex 3 Japanese Grant
Annex 4 Project Monitoring Report (template)
Annex 5 Major Undertakings to be taken by the Government of the Republic of Fiji
Annex 6 Summary of Discussion at the meeting between the delegation of New Zealand and JICA



Location of the Republic of Fiji

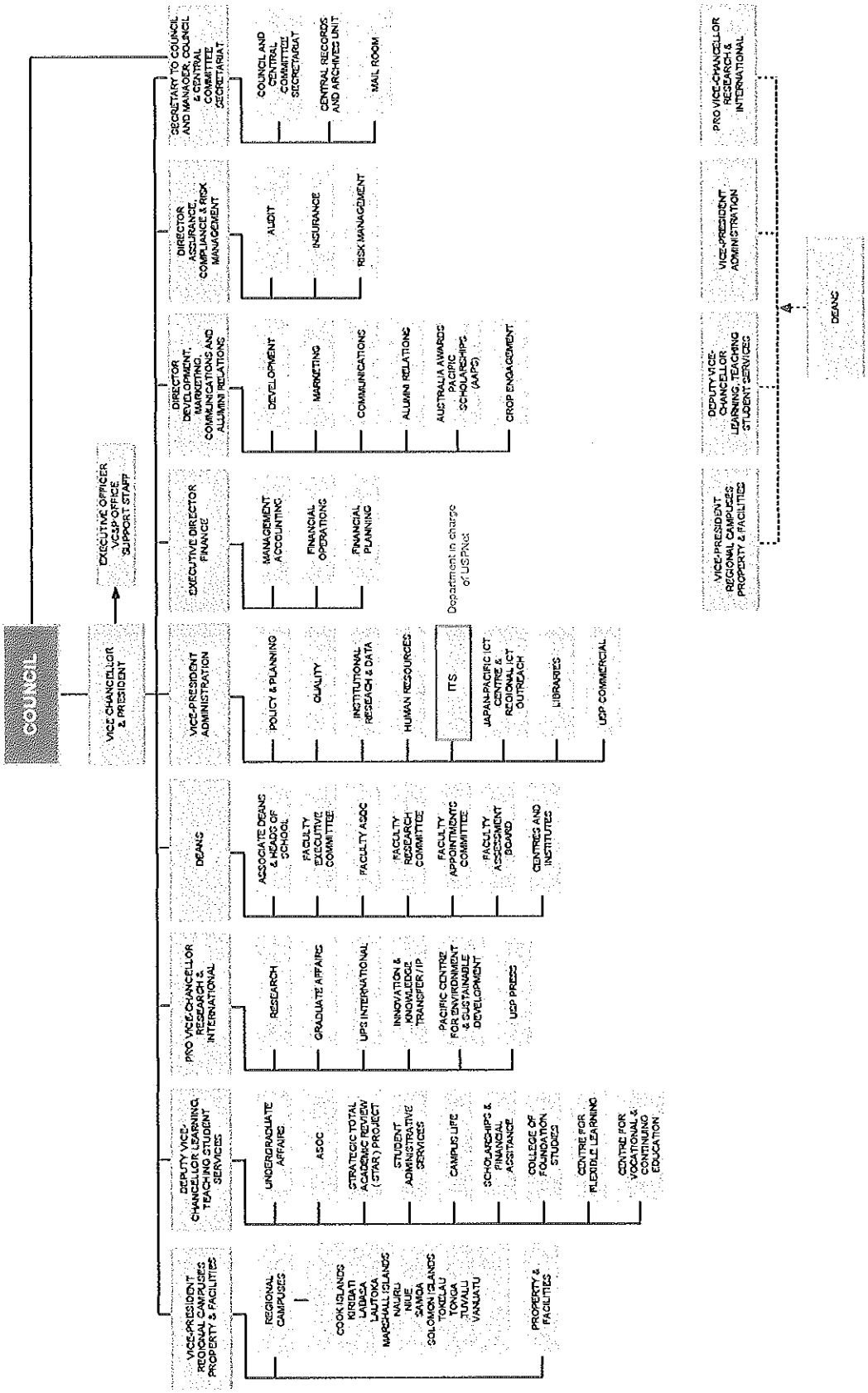


Location of Suva



Loeation of the Project site in Suva

Annex 2 Organization Chart



Annex 3

JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as "the Recipient") to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as "Project Grants").

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See "PROCEDURES OF JAPANESE GRANT" for details):

(1) Preparation

- The Preparatory Survey (hereinafter referred to as "the Survey") conducted by JICA

(2) Appraisal

-Appraisal by the government of Japan (hereinafter referred to as "GOJ") and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

-The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as "the G/A")

-Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as "the B/A")

-Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as "the Bank") to receive the grant

Construction works/procurement

-Implementation of the project (hereinafter referred to as "the Project") on the basis of the G/A

(4) Ex-post Monitoring and Evaluation

-Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the

Contractor, before start of construction.

b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.

2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

PROCEDURES OF JAPANESE GRANT

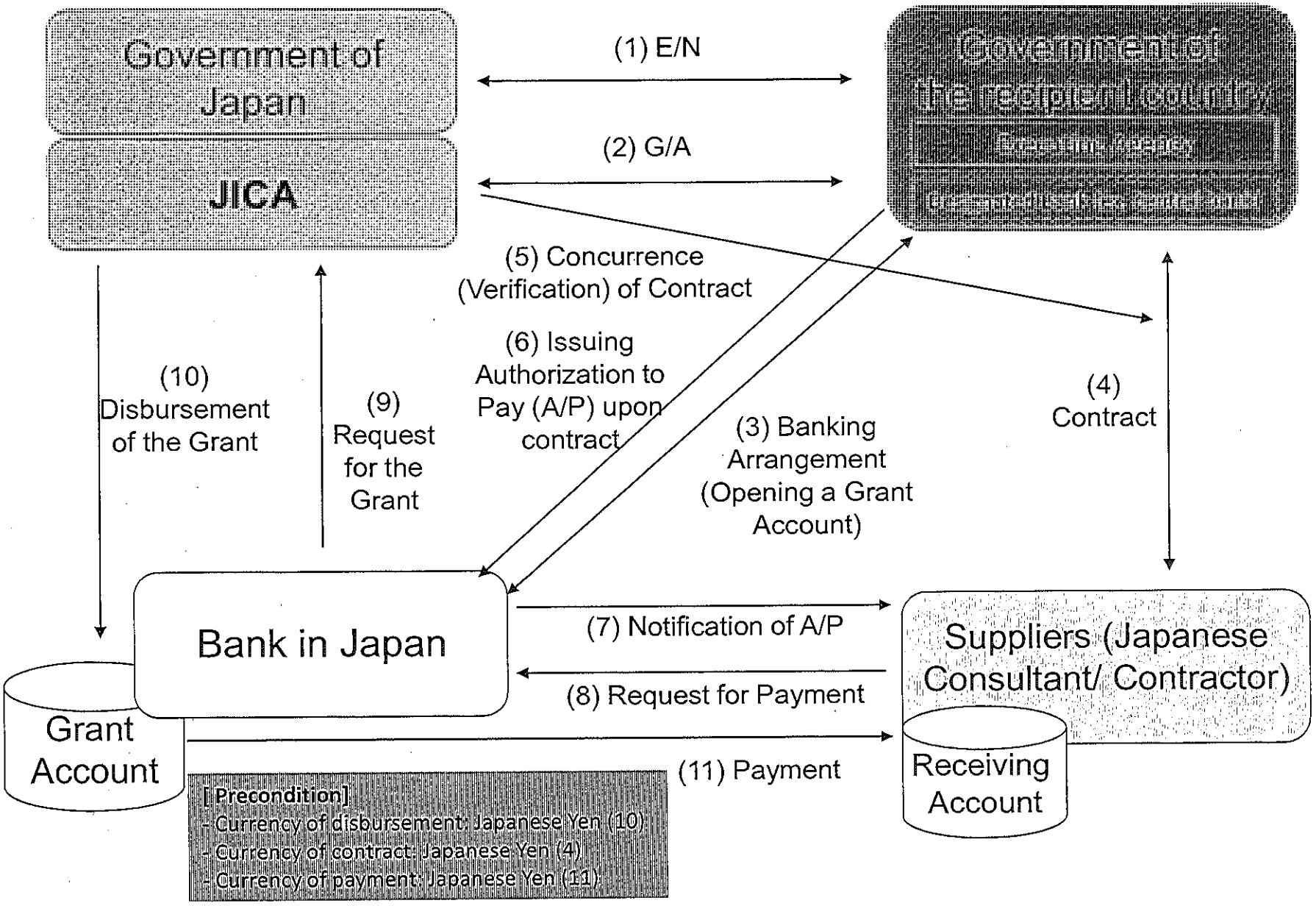
Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2)Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3)Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detail design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is reqnired	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
	(14) Completion certificate		x			x	x	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.

2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

Financial Flow of Japanese Grant (A/P Type)



Project Monitoring Report
on
the Project for the Enhancement of USPNet Communication System
Grant Agreement No. XXXXXXX

20XX, Month

Organizational Information

Signer of the G/A (Recipient)	Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Executing Organization	**University of South Pacific** Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Line Ministry	**Ministry of Education, Heritage & Arts** Person in Charge (Designation) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

1: Project Description

1-1 Project Objective

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original *(proposed in the outline design)*	Actual
1.		

2-2 Scope of the work

Components	Original* *(proposed in the outline design)*	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	*(at the time of signing the Grant Agreement)*	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original *(proposed in the outline design)*	Actual *(in case of any modification)*	Original[1),2)] *(proposed in the outline design)*	Actual
	1.			

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Organization

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original *(at the time of outline design)* name: role: financial situation: institutional and organizational arrangement (organogram): human resources (number and ability of staff):
Actual *(PMR)*

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original *(at the time of outline design)*
Actual *(PMR)*

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original *(at the time of outline design)*

Actual *(PMR)*

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks *(at the time of outline design)*

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
	Contingency Plan (if applicable):
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

	Contingency Plan (if applicable):
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant

Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
- Contractor's Main Staff List

4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final)only)
8. Pictures (by JPEG style by CD-R) (PMR (final)only)
9. Equipment List (PMR (final)only)
10. Drawing (PMR (final)only)
11. Report on RD (After project)

Attachment 6

Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

	Items of Specified Materials	Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C−D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

	Items of Specified Materials	1st ●month, 2015	2nd ●month, 2015	3rd ●month, 2015	4th	5th	6th
1	Item 1						
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

-

-

-

Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

Annex 5

Major Undertakings to be taken by the Government of the Republic of Fiji

1. Specific obligations of the Government of the Republic of Fiji which will not be funded with the Grant

(1) Before the Tender

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To open bank account (B/A)	within 1 month after the signing of the G/A	Ministry of Economy		
2	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract	USP/Mo EHA or Reserve Bank of Fiji		
3	To approve IEE/EIA(Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation.	within 1 month after the signing of the G/A	USP/Mo EHA		
4	To secure and clear the following lands 1)project sites	before notice of the bidding document	USP/Mo EHA		
5	To obtain the planning, zoning, building permit	before signing of G/A	USP/Mo EHA		
6	To submit Project Monitoring Report (with the result of Detail Design)	before preparation of bidding documents	USP/Mo EHA		

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Supplier(s)	within 1 month after the signing of the contract(s)	USP/Mo EHA or Reserve Bank of Fiji		
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A		USP/Mo EHA		
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	USP/Mo EHA		
	2) Payment commission for A/P	every payment	USP, Mo EHA		
3	to ensure prompt unloading and customs clearance at ports of disembarkation in recipient country and to assist the Supplier(s) with internal transportation therein	during the Project	USP, Mo EHA		
4	To accord Japanese nationals and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work	during the Project	USP/Mo EHA		

5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted or be borne by its designated authority without using the Grant];	during the Project	USP/Mo EHA		
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	USP/Mo EHA		
7	Construction of the gate(s) and fence(s) in and around the Project site(s)	during the Project	USP/Mo EHA		
8	1)To submit Project Monitoring Report after each work under the contract(s) such as shipping, hand over, installation and operational training	within one month after completion of each work	USP/Mo EHA		
	2)To submit Project Monitoring Report (final)	within one month after signing of Certificate of Completion for the works under the contract(s)	USP/Mo EHA		
9	To submit a report concerning completion of the Project	within six months after completion of the Project	USP/Mo EHA		

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure Routine check/Periodic inspection	After completion of the construction	USP/Mo EHA		
2	To provide security to the Equipment after the handing over of the Equipment		USP/Mo EHA		

2. Other obligations of the Government of the Republic of Fiji funded with the Grant

NO	Items	Deadline	Amount (Million Japanese Yen)*
^1	Procurement, Installation and Construction	TBD	
	1) To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	a) Marin (Air) transportation of the products from Japan to the recipient country		
	2)To provide equipment with installation and commissioning		
	3) Related necessary technical assistances		
2	To implement detailed design, bidding support and procurement supervision (Consulting Service)		
	Total		

* The Amount is provisional. This is subject to the approval of the Government of Japan.

Annex 6

差出人:
日時: 2017年6月21日 15:29
宛先:
CC:

添付: 【English】Follow Up Survey_final report.pdf; Summary of meeting USPNetv1.doc
件名: Summary of meeting and Previos Study report of USPNet

Dear Mr. Rowe, Mr. Stewardson, Mr. Seaden

Greeting from JICA Survey team.

Thank your for coming to our Fiji office yesterday.
We believe that we have fruitiful discussions for our collabolation in USPNet Project

We have summrised yesterday's discussion as attached.
Kindly received the summary for your reference.

As we promised, we would like to share the study report for the rehabilitation of exsinting C-band antenna.

You can also access from the following link.
http://libopac.jica.go.jp/images/report/P1000028002.html

If we have find out other related information, we will share you in other occasion.

Kind regards.

(English) https://youtu.be/jaztCzL6mGE

独立行政法人 国際協力機構
社会基盤・平和構築部 計画・調整課
兼 運輸交通・情報通信グループ 第二チーム
筱 正雄

2017/06/22

Summary of Meeting (prepared by JICA Mission Team)
with New Zealand High Commission delegation for the Project
for the Enhancement of USPNet Communication System discussions

Time, Date, and Venue: 10:00 – 11:00 am, Tuesday, June 20, 2017, JICA Fiji office

1. Background

The objective of this meeting was to discuss the demarcation for USPNet Communication System Project among the Government of New Zealand, University of South Pacific (USP) and JICA. Prior to the meeting, USP had suggested that the short term solutions for USPNet infrastructure[1] can be included to the component of contribution from the Government of New Zealand, during the discussion between USP and JICA on June 19, 2017. In relation to the suggestion, JICA requested this meeting with the representatives of the Government of New Zealand and discussed the demarcation for the Project.

2. Major Points Discussed

1) The New Zealand representatives explained to JICA that the short term solution for USPNet infrastructure is already included in the component of contribution from the Government of New Zealand to USP, as described in the Activity Design Document titled "USPNet infrastructure Upgrade". Therefore, it is logically possible to cover the short term solution by the contribution.
2) JICA representatives would continuously follow this issue and remind USP to appropriately coordinate the demarcation among the Government of New Zealand, USP and JICA.
3) JICA representatives agreed to proactively share the holding data and information related to the short term solution both to the Government of New Zealand and USP in order to support its smooth implementation.
4) The long term solution[2] should be implemented by USP, the Government of New Zealand and JICA through fully coordinated manner, by using both the Activity Design Document prepared for the contribution of the Government of New Zealand titled "USPNet infrastructure Upgrade" and the Japanese Grant Aid project's preparatory survey.

Attachment: List of Meeting Attendances

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[1] Short term solution means rehabilitation of existing C-band antenna.
[2] The long term solution contains the describing the future plan of USPNet, upgrading the Hub station and upgrading remote satellite station.

Attachment

List of Attendances

New Zealand representatives:

1) Mr. Jonathan Rowe, Counsellor- Development, New Zealand High Commission in Fiji.

2) Mr.Paul Seaden, Principal Development Manager, ICT, Sustainable Economic Development Division, New Zealand Foreign Affairs and Trade Aid Programme

3) Mr. Tim Stewardson, Development Officer, Sustainable Economic Development Division, New Zealand Foreign Affairs and Trade Aid Programme

4) Ms. Surava Elaisa, Development Programme Coordinator, , New Zealand High Commission in Fiji.

JICA representatives:

JICA Survey Team

1)Mr.Tomoyuki NAITO, Leader

2)Mr. Masao SHINO, Project Coordinator

3)Mr. Kiyofusa TANAKA, Chief Consultant,

4)Mr.Yousuke IKEDA, Sub Chief Consultant

5)Mr.Hiroshi SASANUMA, Satellite Communication

6)Mr. Kazuyoshi FUKUSHIMA, Operation and Maintenance Planning

7)Mr. Tetsuhiro YAMASHITA, Antenna Foundation

8)Mr. Yuji, UENO, Country Officer, Pacific and Southeast Asia Division, Southeast Asia and Pacific Department, JICA

JICA Fiji office

1)Mr.Hiroyuki SAWADA, Chief Representative

2)Mr.Shinya TAMIO, Deputy Chief Representative

3)Mr. Shunichiro IKEDA, Assistant Resident Representative

4)Ms. Kozue SHIMIZU, Assistant Resident Representative

5)Ms. Frances FINAU, Programme Officer.

PAUL SEADEN

MINISTRY OF FOREIGN AFFAIRS & TRADE
NEW ZEALAND

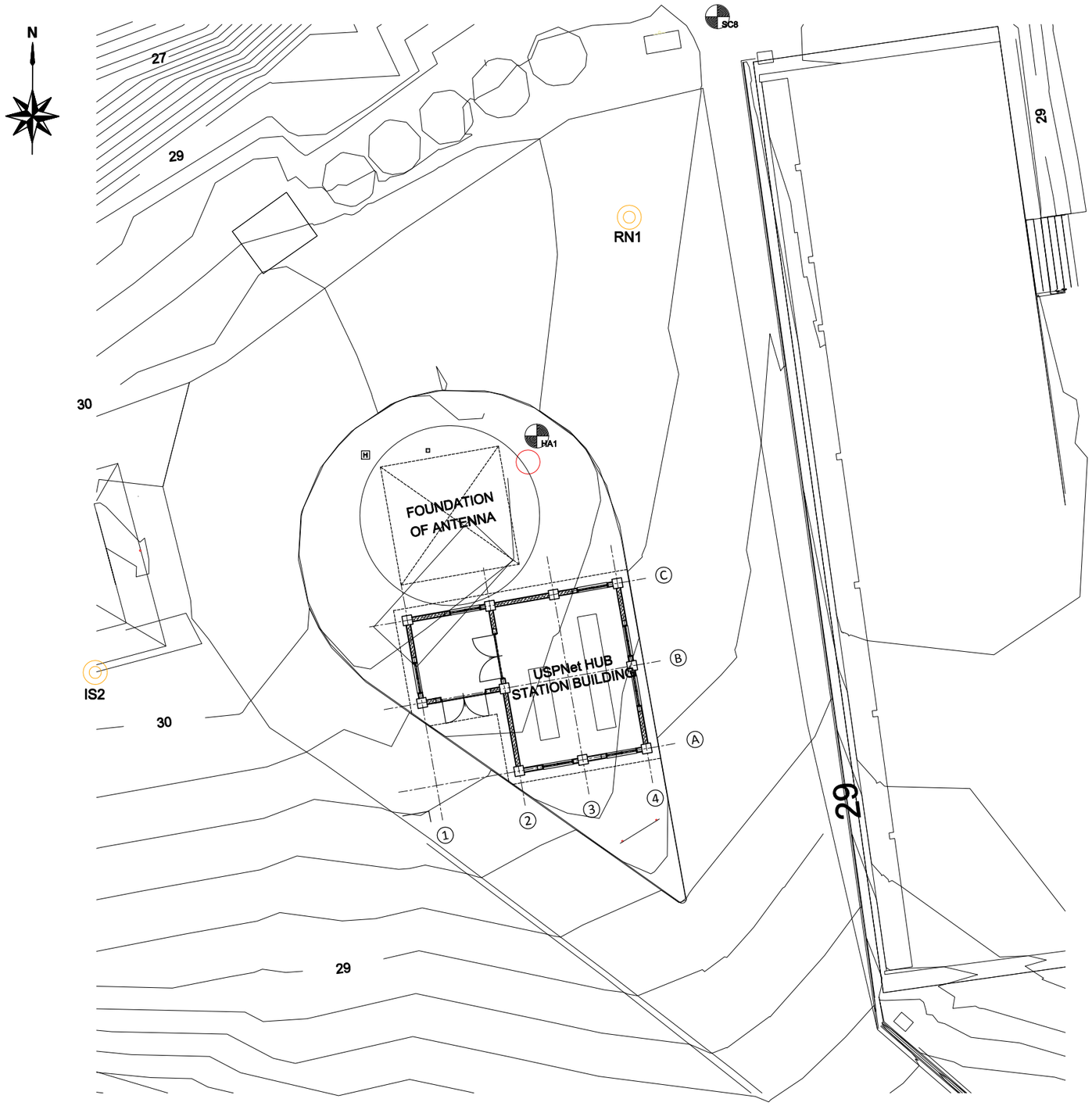
22/6/17

Appendix 5 Outline Design Drawings

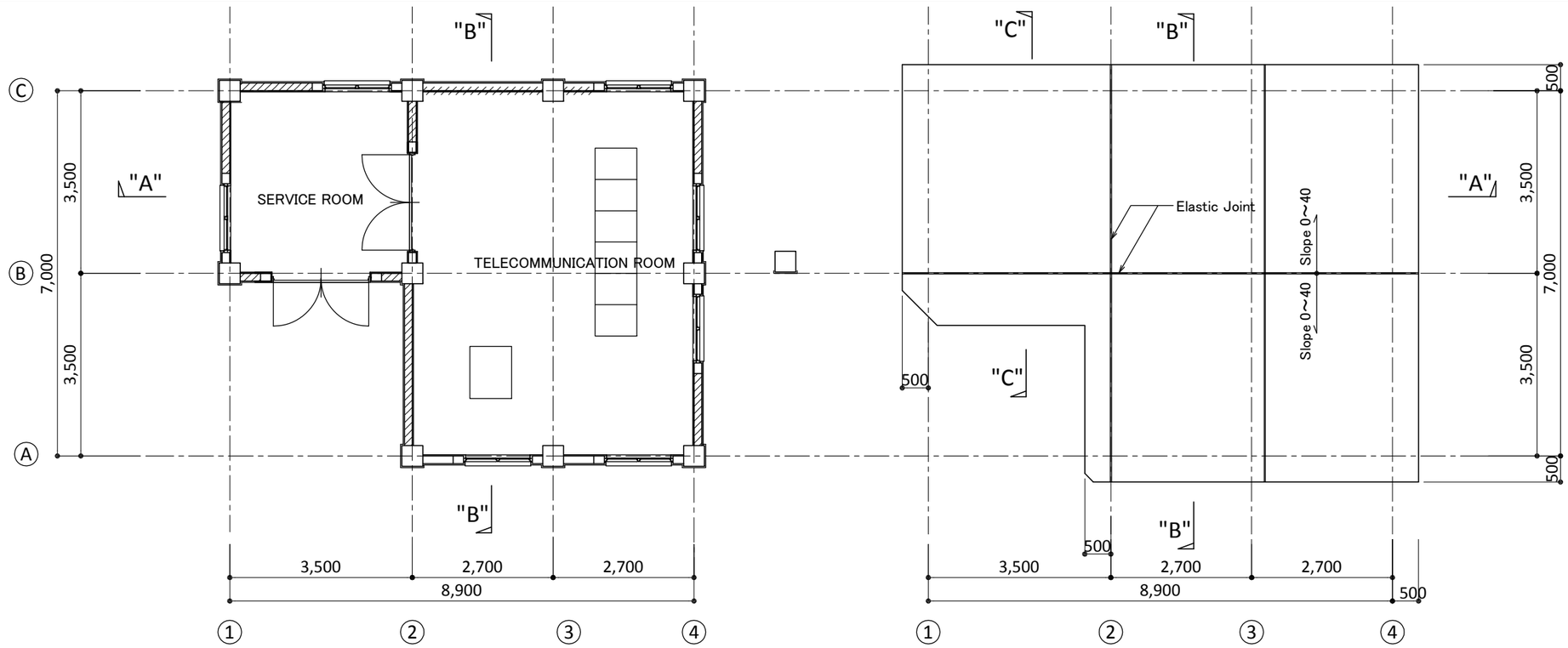
5. Outline Design Drawings

No	Name of Drawings
G-01	LOCATION OF THE PROJECT SITE
A-01	USPNet HUB STATION BUILDING SITE PLAN
A-02	USPNet HUB STATION BUILDING FLOOR PLAN
A-03	USPNet HUB STATION BUILDING ELEVATION & SECTION PLAN
E-01	USPNet HUB STATION BUILDING LAYOUT PLAN
E-02	USPNet HUB STATION BUILDING ELECTRICAL EQUIPMENT
E-03	USPNet HUB STATION BUILDING LIGHTING, SOCKET OUTLET & AIR CONDITIONER PLAN
E-04	USPNet HUB STATION BUILDING INSTALLATION PLAN FOR SATELLITE COMMUNICATION EQUIPMENT, CABLE DUCT & CABLE RACK
E-05	USPNet HUB STATION BUILDING PLAN FOR LIGHTNING PROTECTION
F-01	USPNet HUB STATION FOUNDATION OF PARABOLIC ANTENNA
T-01	NEW USPNet WITH Ku BAND
T-02	USPNet Ku BAND HUB STATION BLOCK DIAGRAM
T-03	USPNet Ku BAND HUB STATION SYSTEM BLOCK DIAGRAM WITH ITEM NO.
T-04	ANTENNA EQUIPMENT

PROJECT NAME	EXECUTING AGENCY	TITLE	SCALE	DATE	DESIGNED	CHECKED	APPROVED	DWG No.
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	Location of The Project Site	---	Dec. 2017	K. Nakamura	T. Yamashita	K. Tanaka	G-01
				YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				



PROJECT NAME	EXECUTING AGENCY	TITLE	SCALE	DATE	DESIGNED	CHECKED	APPROVED	DWG No.
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	USPNet HUB STATION BUILDING SITE PLAN	1:200 (if only A3)	Dec. 2017	T. Nakamura	T. Yamashita	K. Tanaka	A-01
				yec YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				



GROUND FLOOR PLAN

ROOF PLAN

EXTERIOR FINISHING SCHEDULE

LOCATION	SPECIFICATION
ROOF	PROTECTION CONCRETE WITH WELDED WIRE MESH : STEEL TROWEL FINISH INSULATION BOARD t=25mm, ASPHALT MEMBRANE WATER PROOFING
WALL	PAINT FINISH (A.E.P) ON 150mm Thickness CONCRETE BLOCK WITH MORTAR STEEL TROWEL 25mm THCKNESS
COLUMN ・BEAM	PAINT FINISH (A.E.P) ON MORTAR STEEL TROWEL 25mm THCKNESS

INTERIOR FINISHING SCHEDULE

ROOM / LOCATION	SERVICE ROOM	TELECOMMUNICATION ROOM
FLOOR	VYNIL TILE 300 X 300 t=2.0mm ON MORTAR BED FINISH THICKNESS 30mm	VYNIL TILE 300 X 300 t=2.0mm ON MORTAR BED FINISH THICKNESS 30mm
BASEBOARD	VYNIL TILE H=100 ON MORTAR STEEL TROWEL 20mm THICKNESS ON 150mm THICKNESS CONCRETE BLOCK	VYNIL TILE H=100 ON MORTAR STEEL TROWEL 20mm THICKNESS ON 150mm THICKNESS CONCRETE BLOCK
WALL	PAINT FINISH(E.P) H=100 MORTAR STEEL TROWEL 20mm THICKNESS ON 150mm THICKNESS CONCRETE BLOCK	PAINT FINISH(E.P) H=100 MORTAR STEEL TROWEL 20mm THICKNESS ON 150mm THICKNESS CONCRETE BLOCK
CEILING	PAINT FINISH (E.P) EXPOSED CONCRETE (WITH REPAIR)	PAINT FINISH (E.P) EXPOSED CONCRETE (WITH REPAIR)
REMARKS		

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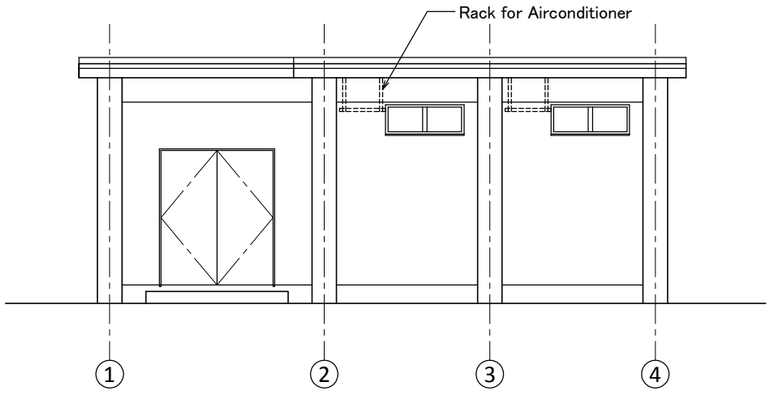
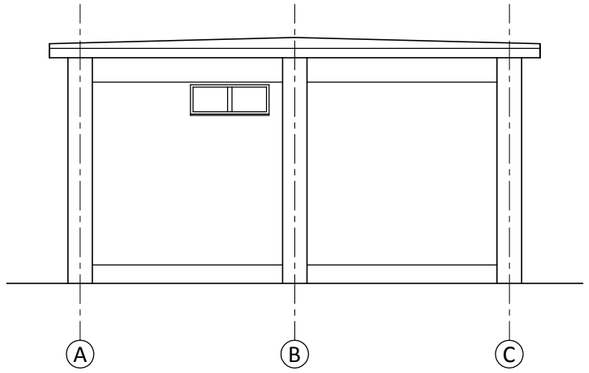
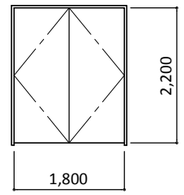
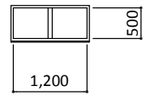
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	USPNet HUB STATION BUILDING FINISHING SCHEDULE & PLAN	1:100 (if only A3)	Dec. 2017	T. Nakamura	T. Yamashita	K. Tanaka	A-02
				YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				

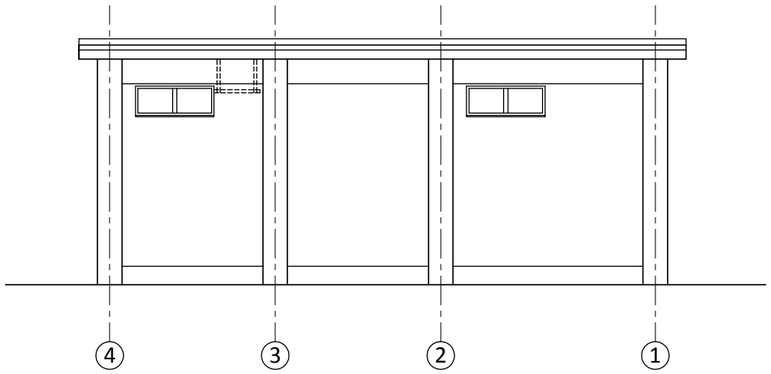


SOUTH ELEBATION

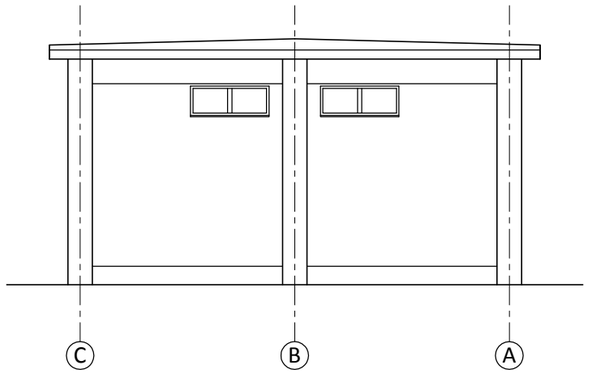


WEST ELEBATION

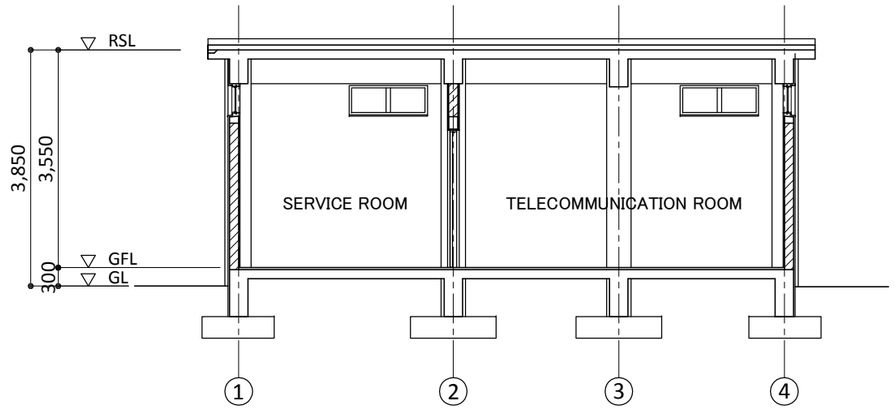
SYMBOL & Qty.	1 / WD X 2	1 / AW X 7
ELEVATION		
TYPE	DOUBLE SWING DOOR	FIXED WINDOW
MATERIAL & FINISH	WOOD PAINT(OP)	ALUMINUM ·ELECTRO COLOR
GLASS		CLEAR GLASS t=5
HARDWEAR	HINGE, LEVER HANDLE, STOPPER DOOR CLOSER, CYLINDER LOCK	READY MADE HARDWARE
REMARK	STAINLESS DOOR SILL	



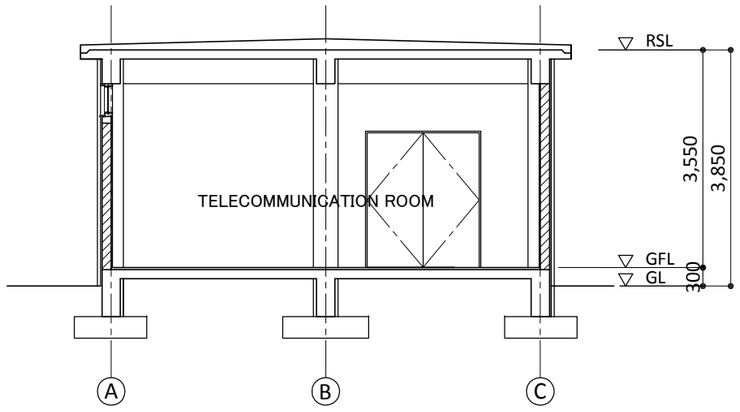
NORTH ELEBATION



EAST ELEBATION

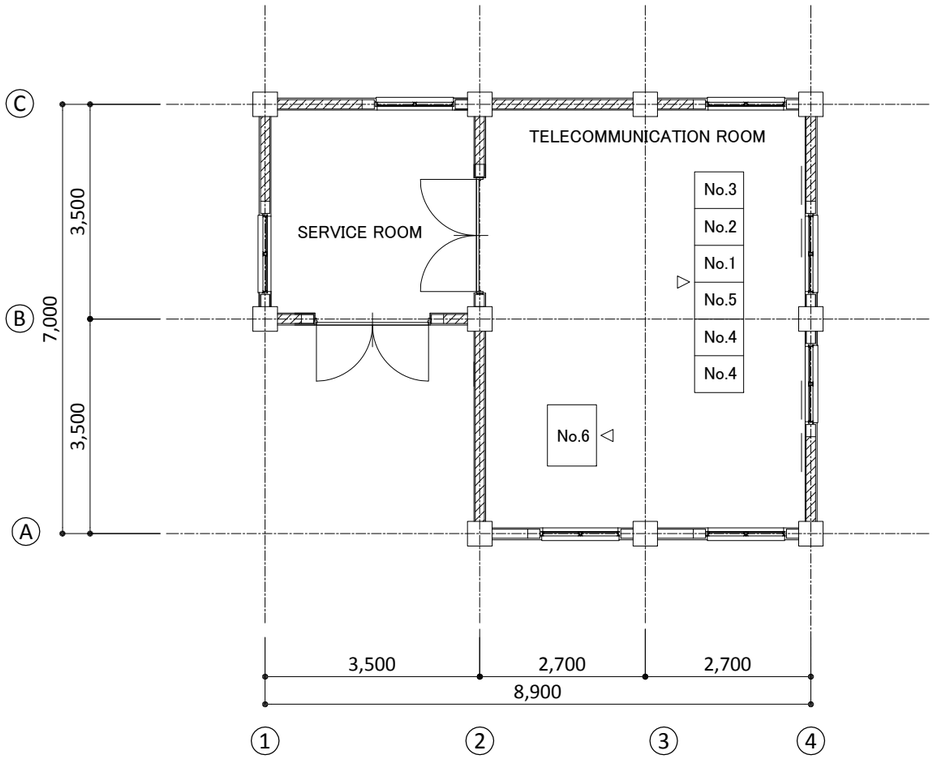


SECTION "A" - "A



SECTION "B" - "B

PROJECT NAME	EXECUTING AGENCY	TITLE	SCALE	DATE	DESIGNED	CHECKED	APPROVED	DWG No.
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	USPNet HUB STATION BUILDING ELEVATION & SECTION	1:100 (if only A3)	Dec. 2017	T. Nakamura	T. Yamashita	K. Tanaka	A-03
				YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				



INSTALLATION PLAN FOR SATELLITE COMMUNICATION EQUIPMENT

No.	Item
1	Parabolic Antenna System （Beacon Receiber, Control Unit, Drive Unit）
2	Low Frequency Converter System （Distribution Device, IF Monitor Port, Selection Device）
3	Block Up Converter System （Interface Device, Control Unit, Selection Device）
4	Base Band System
5	Monitoring and Control System
6	Uninterruptible Power Supply (UPS)

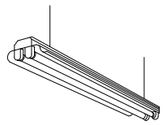
PROJECT NAME	EXECUTING AGENCY	TITLE	SCALE	DATE	DESIGNED	CHECKED	APPROVED	DWG No.
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	USPNet HUB STATION BUILDING LAYOUT PLAN	1:100 (if only A3)	Dec. 2017	T. Yamashita	Y. Ikeda	K. Tanaka	E-01
				yec YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				

MAIN FEEDER & POWER SYSTEM	
	DISTRIBUTION BOAD
LIGHTING SYSTEM	
	FL32W x2 HANGING TYPE
	FL32W x1 HANGING TYPE
	FL32W x1 SURFACE MOUNT (WATER PROOF TYPE)
	LIGHTING SWITCH 1P 15A 1−WAY
SOCKET OUTLET SYSTEM	
	SOCKET OUTLET 2P×2 100V/15A
3	SOCKET OUTLET 3P×1

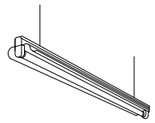
WIRING	
	WIRING IV 2.0mm x2, E2.0 (E19)
	WIRING IV 2.0mm x3, E2.0 (E25)
	PULL BOX 200×200×100

LIGHTING FIXTURE SCHEDULE

A	HANGING TYPE
	32W x 2



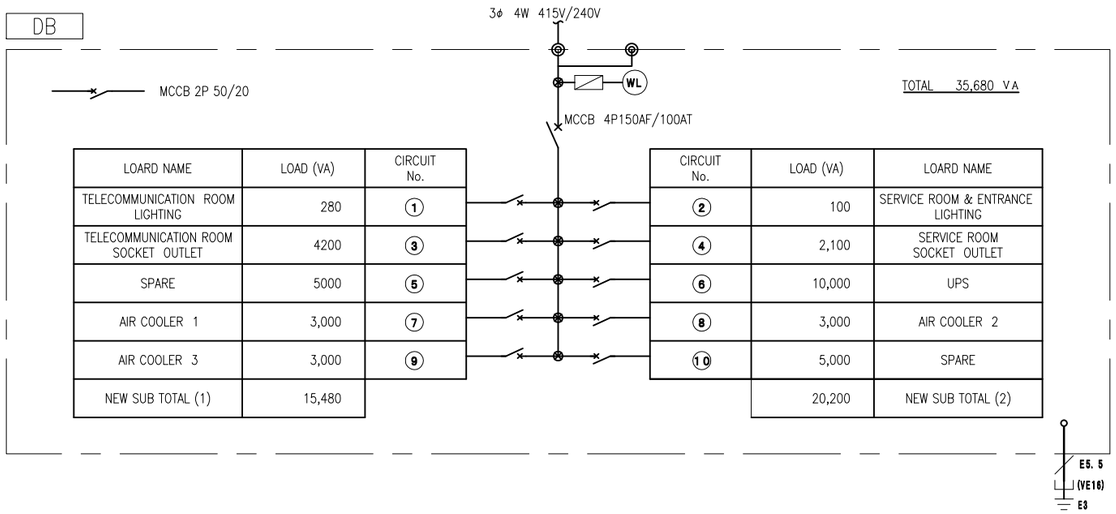
B	HANGING TYPW
	32W x 1



C	WATER PROUF TYPE
	FL32W × 1

LEGEND
1.RATED VOLTAGE : 3φ 3W 240V−50Hz
2.STARTER(FLUCRESCENT LANP) : GLOW STARTER
3.POWER FACER : HIGH POWER FACTOR

DISTRIBUTION



LOARD NAME	LOAD (VA)	CIRCUIT No.
TELECOMMUNICATION ROOM LIGHTING	280	①
TELECOMMUNICATION ROOM SOCKET OUTLET	4200	③
SPARE	5000	⑤
AIR COOLER 1	3,000	⑦
AIR COOLER 3	3,000	⑨
NEW SUB TOTAL (1)	15,480	

CIRCUIT No.	LOAD (VA)	LOARD NAME
②	100	SERVICE ROOM & ENTRANCE LIGHTING
④	2,100	SERVICE ROOM SOCKET OUTLET
⑥	10,000	UPS
⑧	3,000	AIR COOLER 2
⑩	5,000	SPARE
	20,200	NEW SUB TOTAL (2)

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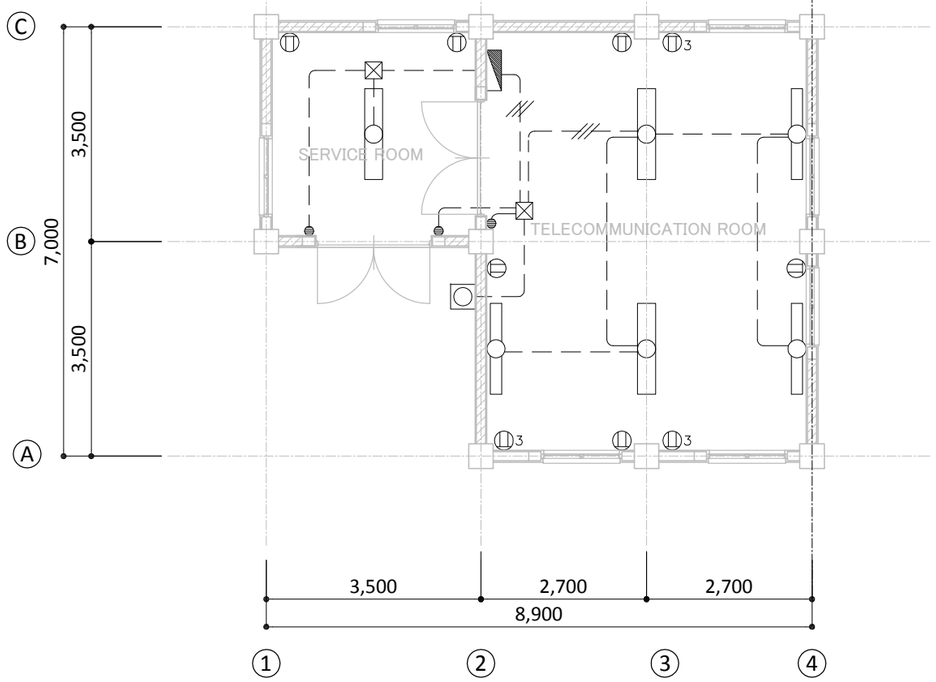
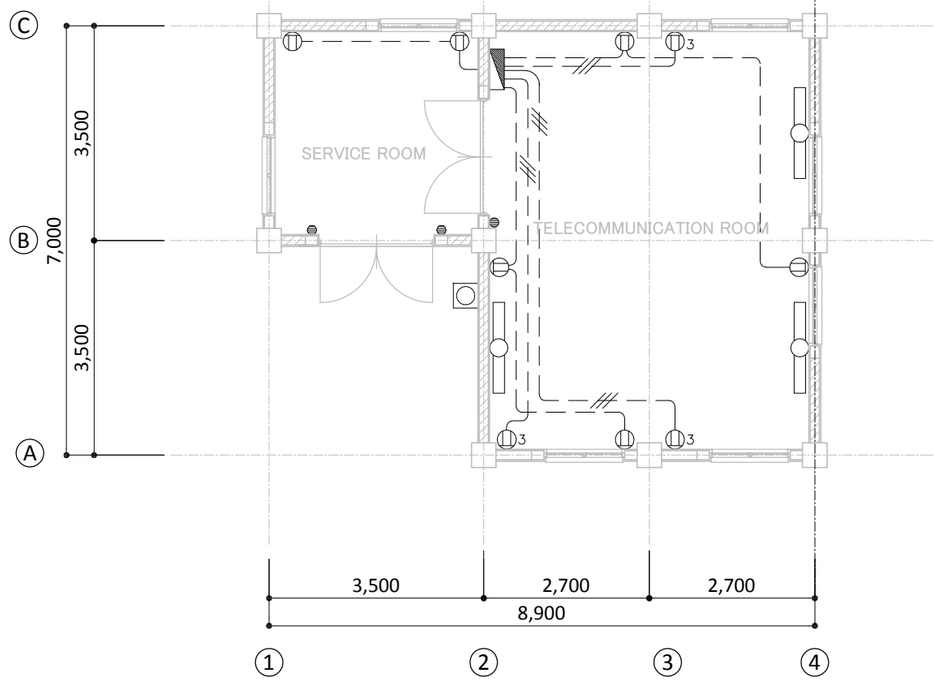
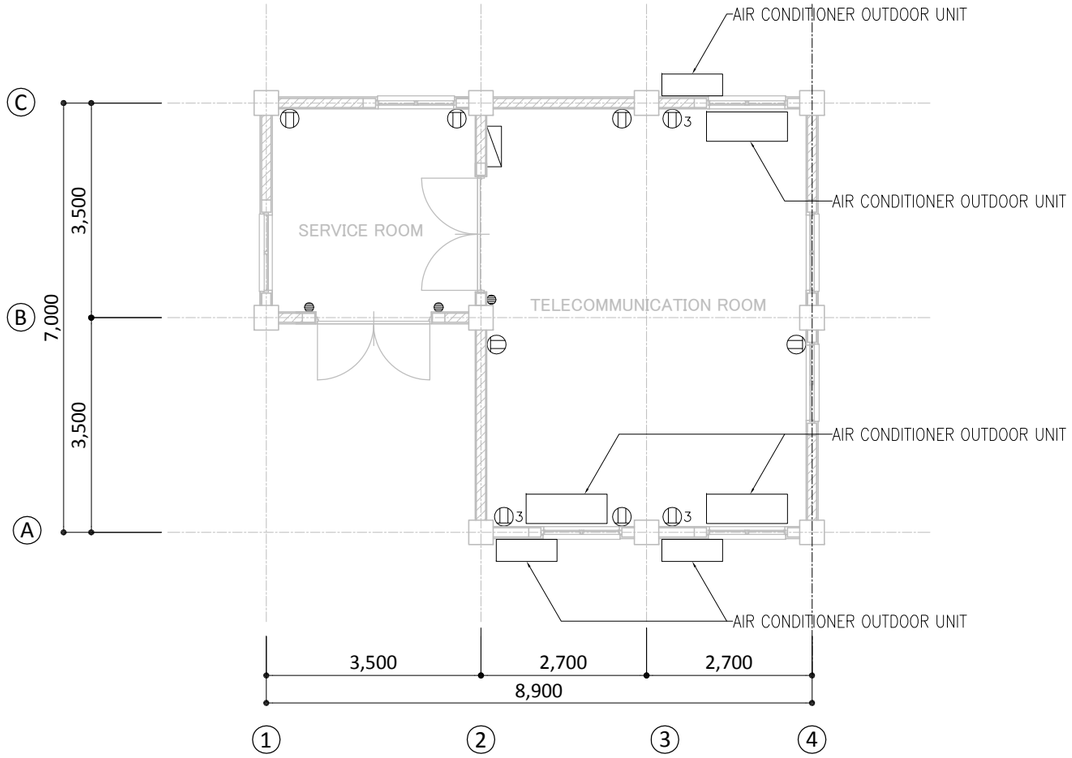
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	USPNet HUB STATION BUILDING ELECTRICAL EQUIPMENT PLAN	1:100 (if only A3)	Dec. 2017	T. Yamashita	Y. Ikeda	K. Tanaka	E-02
				yec YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				



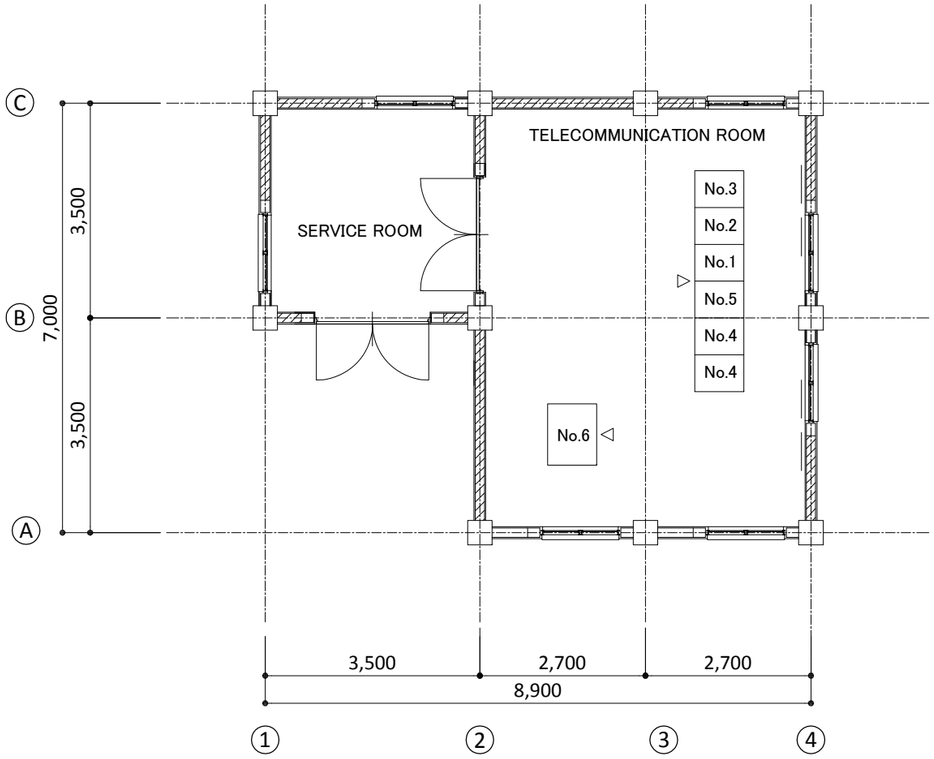
WIRING PLAN FOR LIGHTING



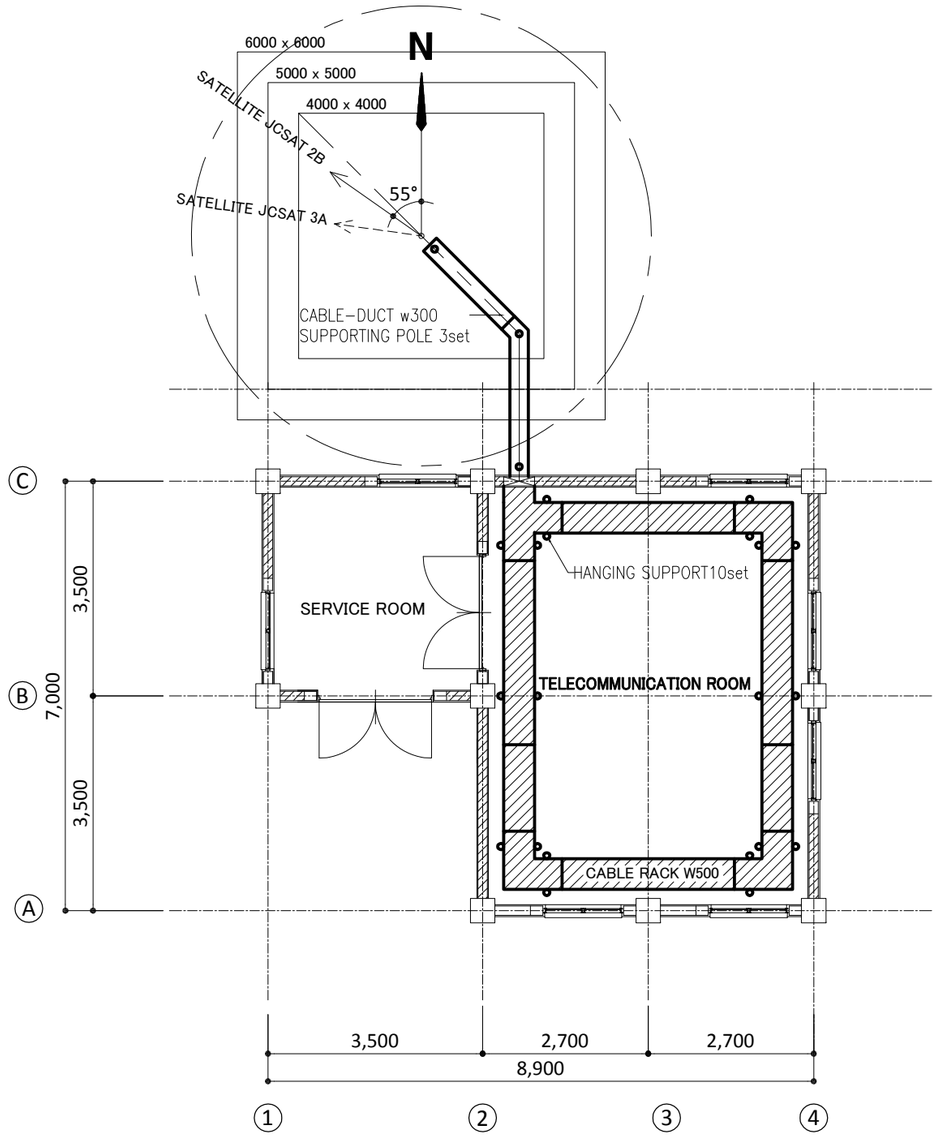
WIRING PLAN FOR SOCKET OUTLET



PROJECT NAME	EXECUTING AGENCY	TITLE	SCALE	DATE	DESIGNED	CHECKED	APPROVED	DWG No.
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	USPNet HUB STATION BUILDING PLAN FOR LIGHTING, SOCKET OUTLET & AIR CONDITIONER	1:100 (if only A3)	Dec. 2017	T. Yamashita	Y. Ikeda	K. Tanaka	E-03
				YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				



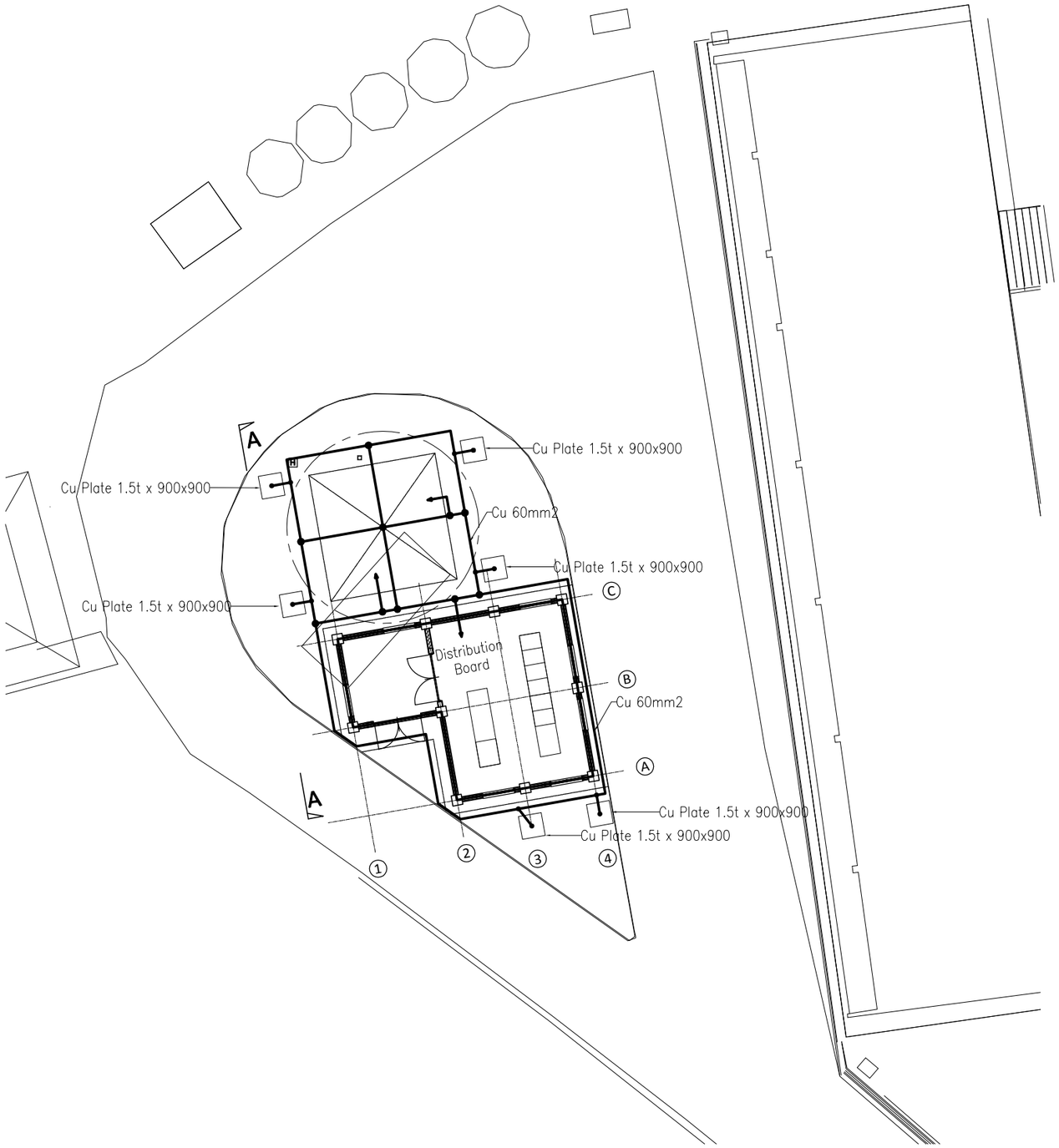
INSTALLATION PLAN FOR SATELLITE COMMUNICATION EQUIPMENT

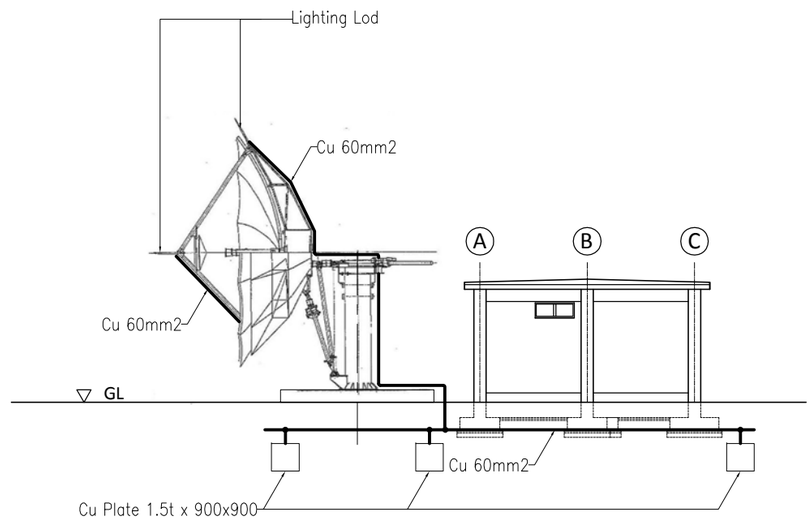


INSTALLATION PLAN FOR CABLE-DUCT & CABLE RACK

USPNet HUB STATION BUILDING

PROJECT NAME	EXECUTING AGENCY	TITLE	SCALE	DATE	DESIGNED	CHECKED	APPROVED	DWG No.
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	USPNet HUB STATION BUILDING INSTALLATION PLAN FOR SATELLITE COMMUNICATION EQUIPMENT, CABLE DUCT & CABLE RACK	1:100 (if only A3)	Dec. 2017	T. Yamashita	Y. Ikeda	K. Tanaka	E-04
				yec YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				



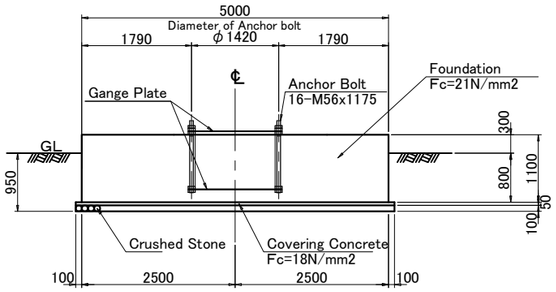


A–A SECTION

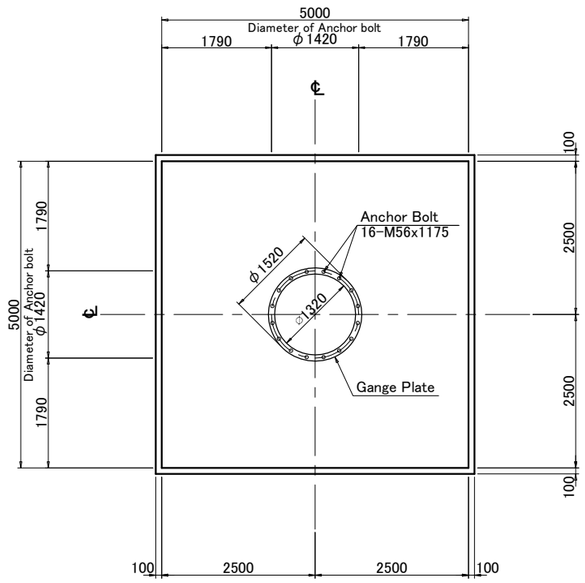
PROJECT NAME	EXECUTING AGENCY	TITLE	SCALE	DATE	DESIGNED	CHECKED	APPROVED	DWG No.
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	USPNet HUB STATION BUILDING PLAN FOR LIGHTNING PROTECTION	1:200 (if only A3)	Dec. 2017	T. Yamashita	Y. Ikeda	K. Tanaka	E-05
				YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				

STRUCTUAL DRAWING S=1/100

SIDE VIEW

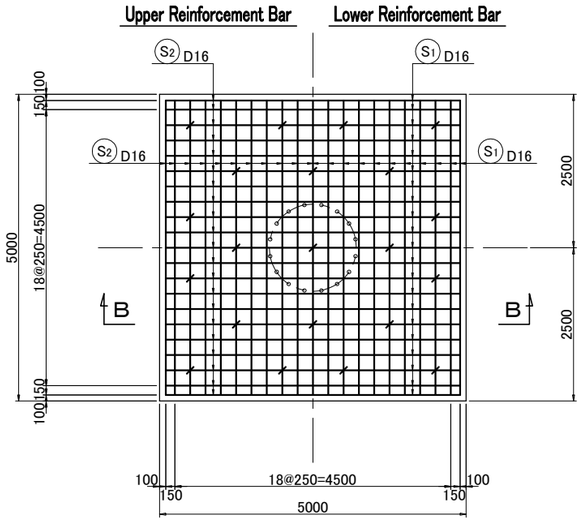


平 面 図

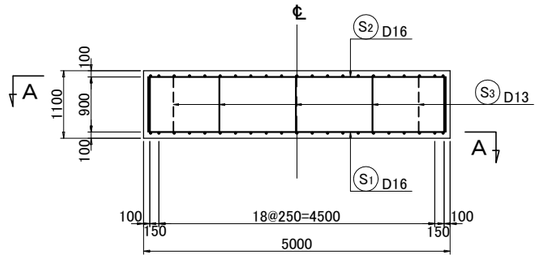


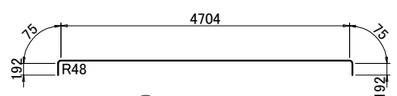
REINFORCEMENT DRAWING S=1/50

SECTION A – A

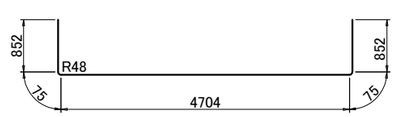


SECTION B – B

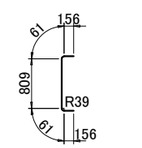




S2 42 – D16 x 5240



S1 42 – D16 x 6560



S3 21 – D13 x 1250

MATERIAL TABLE

Symbol	Diameter	Length	Number	Unit Weight	Weight/Unit	Weight	Shape
Unit	mm	mm	Pce	kg/m	kg	kg	
S1	D16	6 560	42	1.580	10.365	435.3	⌊_⌋
S2	D16	5 240	42	1.580	8.279	347.7	⌐¬
					Sub. Total	783.0 kg	
S3	D13	1 250	21	0.995	1.244	26.1	⊏
					Sub. Total	26.1 kg	
				D16		783.0 kg	
				D13		26.1 kg	
				TOTAL		809.1 kg	
Structure Concrete: Design of strength Fc=21N/mm2							
Reinforcement Bar(D16,D13) Equivalent SD295A							

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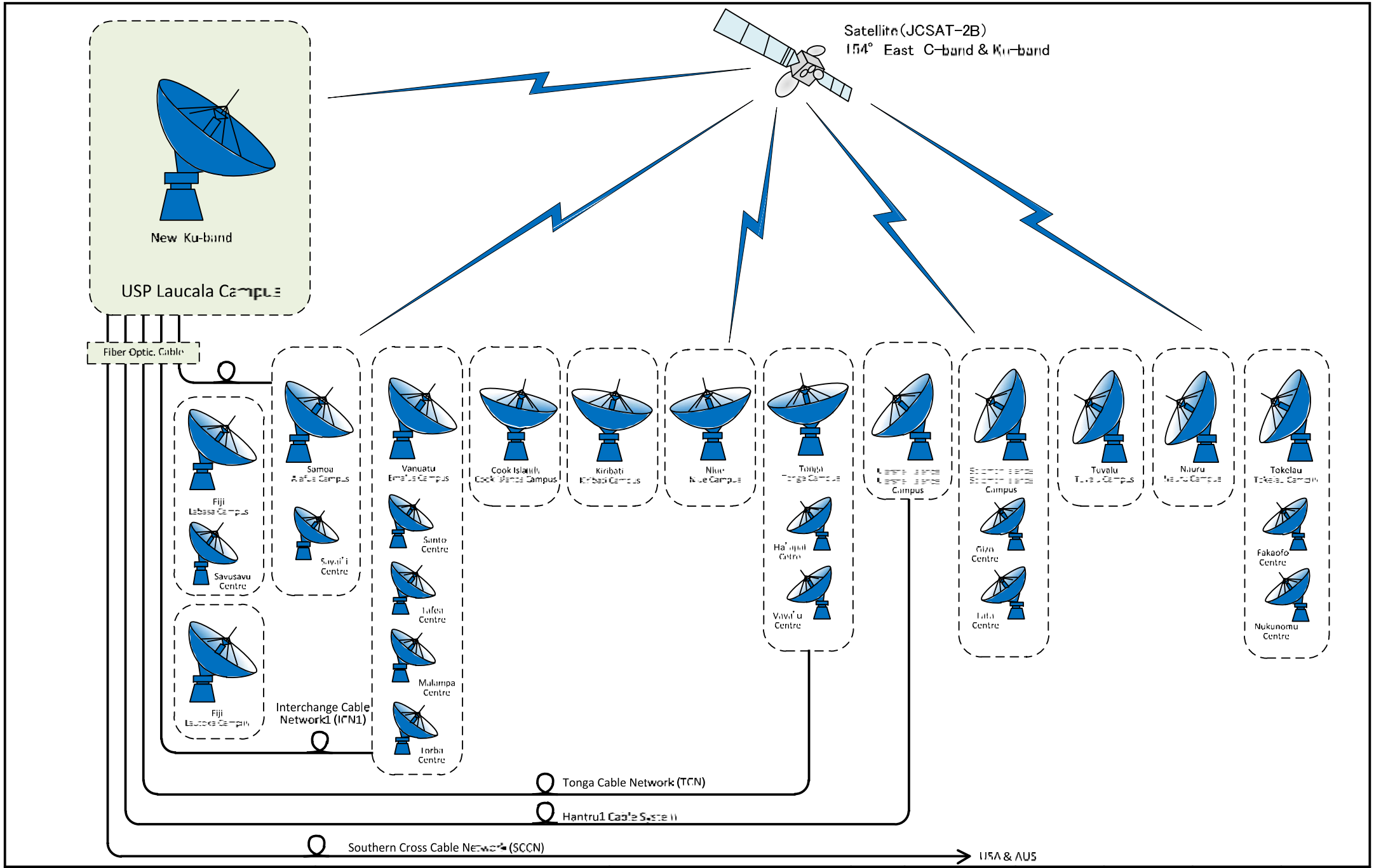
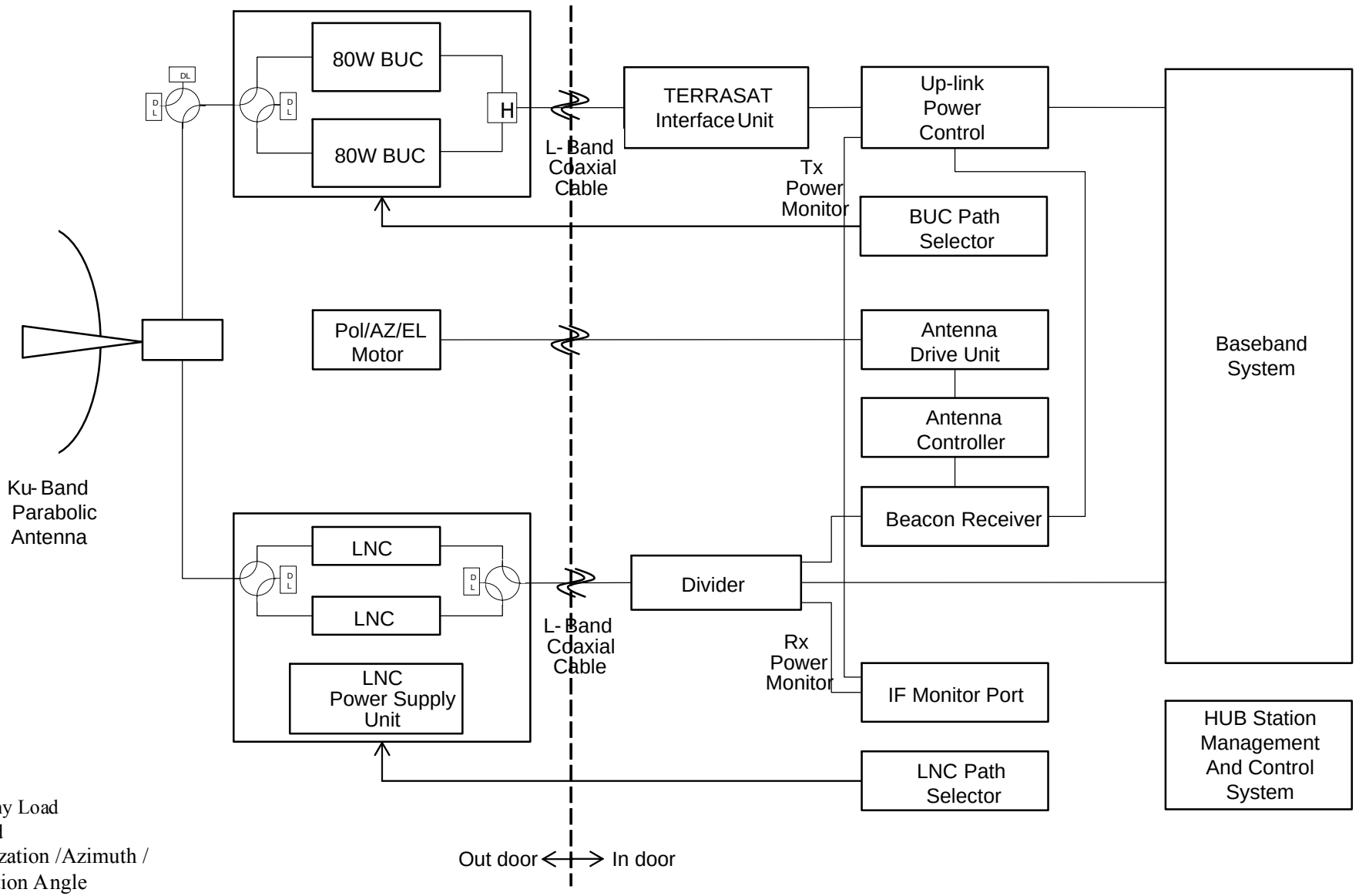
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	USPNet HUB STATION BUILDING FOUNDATION OF PALABOLIC ANTENNA	1:100 (if only A3)	Dec. 2017	T. Yamashita	Y. Ikeda	K. Tanaka	F-01
				YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				

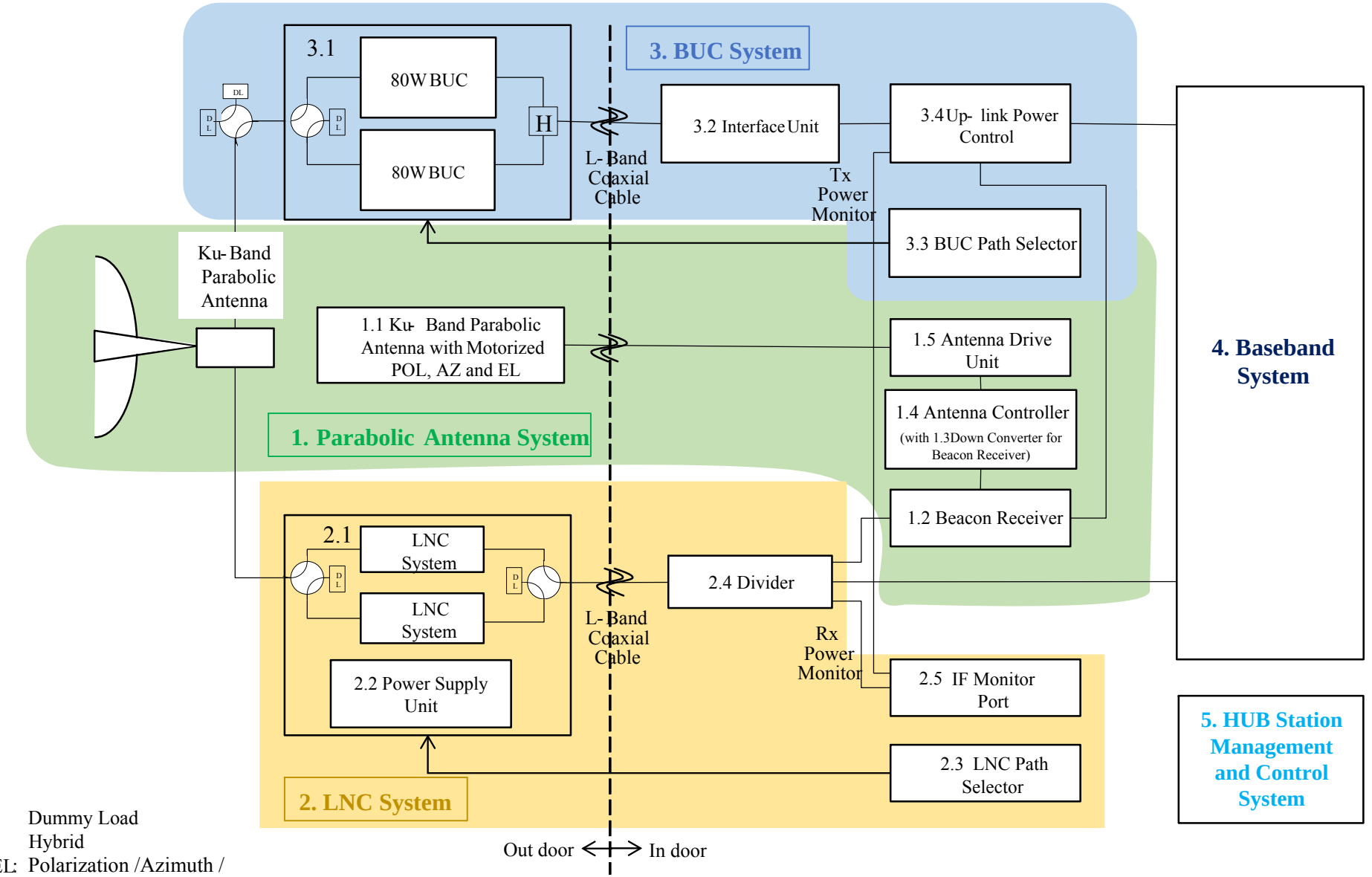


PROJECT NAME	EXECUTING AGENCY	TITLE	SCALE	DATE	DESIGNED	CHECKED	APPROVED	DWG No.
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	NEW USPNet WITH Ku BAND	---	Dec. 2017	H. Sasanuma	K. Nakamura	K. Tanaka	T-01
				YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				



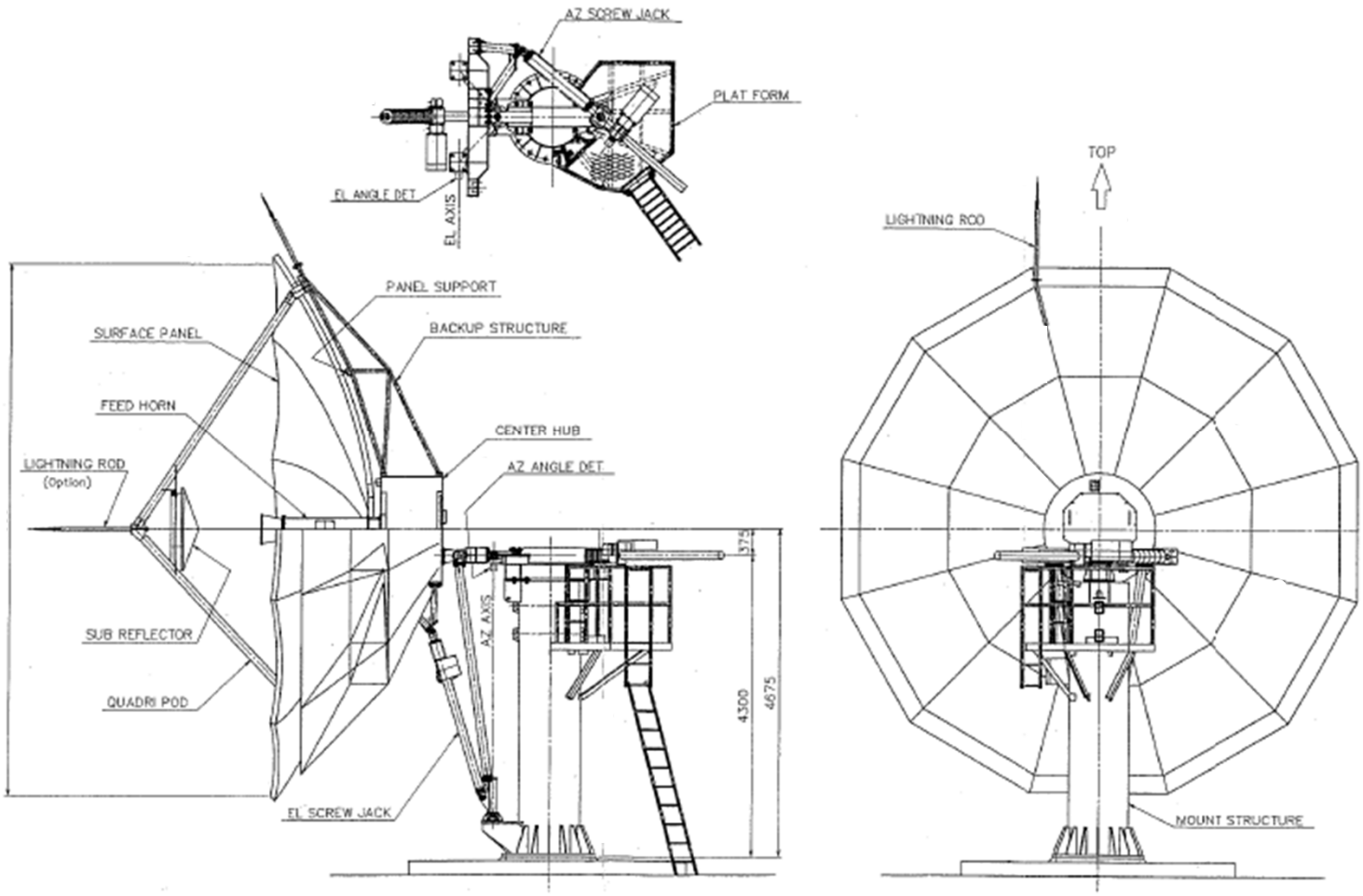
DL: Dummy Load
H: Hybrid
Pol/AZ/EL: Polarization /Azimuth / Elevation Angle
L Band: 1GHz Band

PROJECT NAME	EXECUTING AGENCY	TITLE	SCALE	DATE	DESIGNED	CHECKED	APPROVED	DWG No.
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	Ku BAND HUB STATION SYSTEM BLOCK DIAGRAM	---	Dec. 2017	H. Sasanuma	K. Nakamura	K. Tanaka	T-02
				YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				



DL: Dummy Load
H: Hybrid
Pol/AZ/EL: Polarization /Azimuth / Elevation Angle
L Band: 1GHz Band

PROJECT NAME	EXECUTING AGENCY	TITLE	SCALE	DATE	DESIGNED	CHECKED	APPROVED	DWG No.
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	Ku BAND HUB STATION SYSTEM BLOCK DIAGRAM WITH ITEM NO.	---	Dec. 2017	H. Sasanuma	K. Nakamura	K. Tanaka	T-03
				YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				



PROJECT NAME	EXECUTING AGENCY	TITLE	SCALE	DATE	DESIGNED	CHECKED	APPROVED	DWG No.
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI	The University of the South Pacific	ANTENNA EQUIPMENT	---	Dec. 2017	H. Sasanuma	K. Nakamura	K. Tanaka	T-04
				YACHIYO ENGINEERING CO., LTD. TOKYO, JAPAN				

Appendix 6 Report of Topographic Survey and Soil Investigation

REPORT

Tonkin+Taylor

Enhancement of USPNet Communication System in The Republic of Fiji

Combined Factual and Interpretative Topographical Survey and Soil Explorations Report - Revision 1

Prepared for
Yachiyo Engineering Co.,Ltd.
Prepared by
Tonkin & Taylor International Ltd
Date
September 2017
Job Number
1002886.v2

Exceptional thinking together
www.tonkintaylor.co.nz

Document Control

Title: Enhancement of USPNet Communication System in The Republic of Fiji					
Date	Version	Description	Prepared by:	Reviewed by:	Authorised by:
25/09/2017	Final	Interpretative Topographical Survey and Soil Explorations Report	J Martin	A Pomfret	C Freer
29/09/2017	Final - Rev 1	Updated Site Topographical Plan	J Martin	C Freer	C Freer

Distribution:

Yachiyo Engineering Co.,Ltd.	Electronic
Tonkin & Taylor International Ltd (FILE)	1 copy

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1 Introduction

1.1 General

Tonkin and Taylor International (T+TI) was engaged by Yachiyo Engineering Co., Ltd. (YEC) to undertake geotechnical investigations and topographic survey to aid in the design of foundations for a new parabola antenna within the grounds of The University of the South Pacific (referred to as 'the site') in Suva, Fiji.

The investigations have been largely carried out in accordance with the "Contract of Topographical Survey and Soil Explorations" provided to T+TI by YEC. The geotechnical assessment was undertaken in accordance with our proposal dated 2 June 2017[1]

The scope of work for the geotechnical investigations included:

- 2 No. machine drilled boreholes to a maximum depth of 20 m with Standard Penetration Testing (SPT) at regular intervals;
- Sampling and transportation of sampled soils;
- Laboratory testing on selected samples;
- Assessment of suitable foundation solutions for the proposed structures on the site;
- Preparation of this report outlining the geology, site subsurface conditions and presenting preliminary geotechnical information and recommendations to support the development of the site.

The topographic survey scope of works included:

- A skyline measurement survey, enabling the angle to adjacent buildings and trees to be calculated;
- A site plan of each site with 0.2m contours;
- Plans provided in hard copy and AutoCAD format.

1.2 Project Description

The Republic of Fiji comprises an archipelago of more than 332 islands, of which 110 are permanently inhabited, and more than 500 islets, amounting to a total land area of about 18,300 square kilometres. The two major islands, Viti Levu and Vanua Levu, account for 87% of the population of almost 860,000. The Laucala Campus of The University of the South Pacific (USP), is located in Suva, Fiji. The USP is a Tertiary Education Institute which has over 14 campuses across the Pacific, with the Laucala Bay campus providing education to over 20,000 students from the Pacific.

A new parabolic antenna is proposed within the Laucala Bay USP campus. This antenna will be installed to enhance the USPNet Communication System which is utilised by the University. The antenna is proposed at one of two locations within the campus grounds, for which this geotechnical investigation and topographical survey have been completed.

[1] Tonkin and Taylor International Limited. (2 June 2017), The Project for Enhancement of USPNet Communication System in Republic of Fiji Proposal for Topographical Survey and Soil Investigation works.

2 Site Description

The site is located within the Laucala Bay USP campus, in Suva, Fiji. The site is located on a series of gently to steeply sloping hills which slope upward from Laucala Bay and toward the north-west. The site is approximately 2 km from Suva CBD and 17 km from Nausori Airport. The University campus consists of a number of large multi-level lecture buildings and smaller office and dormitory accommodation buildings in the surrounds. The campus is moderately vegetated and there are a number of small creeks extending through the campus grounds.

Two locations have been proposed for the construction of the new parabola antenna within the University campus. The preferred location is named 'Site 1', with the secondary alternative site named 'Site 2'.

Site 1 is located adjacent to the 'Campus Life Administration Office' buildings, and is situated on the gently sloping crest of a moderately graded hill. There is a change in elevation across the site of approximately 1.0 m (typically 30m RL in the west and 29 m RL in the east). Two small creeks are located within proximity of the site, 40 m to the north and 40 m to the south of the site, respectively. The site, in its current layout, contains a number of shipping containers, office buildings and accommodation dormitories.

Site 2 is located adjacent to the 'Records Office' buildings, and is situated on the gently sloping crest of a steeply graded hill. There is a change in elevation across the site of approximately 0.5 m (typically RL 22.5 m in the west and RL 23.5 m in the east). A small creek is located approximately 25 m to the south-west, downslope of the site. The site, in its current layout, contains a number of shipping containers and office buildings.

Site 1 is approximately 135 m to the south-west of Site 2.

3 Topographical Survey

The ground profile survey was conducted at 0.2m height intervals, and included existing facilities and trees. The scope of work was completed in accordance with 'Contract of Topographical Survey and Soil Explorations' – presented for convenience in Appendix A. The site topographical plan is presented in Appendix B.

A skyline measurement survey was conducted at each site in the orientation of the proposed parabolic antenna. The purpose of the survey was to enable the angle to adjacent buildings and trees to be calculated. The survey was completed at 2m and 4m height above known survey marks, RN1 for Site 1 and IS3 for Site 2. The nominal location of the proposed antenna has also been included in the survey plot. The skyline measurement survey plots are presented in Appendix B.

4 Summary of the Soils Investigations

4.1 Geotechnical Investigation Equipment

The geotechnical investigations were undertaken on the site by means of hand augers (HA), Scala penetrometer tests (SC) and machine boreholes (BH). The hand augers and Scala penetrometer tests were performed by a T+TI geotechnical engineer at the site. The machine drilled boreholes were undertaken by Geotech Drilling International Ltd (GDI) under the supervision of T+TI. The machine drilled boreholes were performed using a tracked rig using HQTT (HQ Triple Tube) wireline techniques with Standard Penetration Testing (SPT) performed at regular intervals. A photo of the drill rig used to drill the machine boreholes is shown in Figure 4.1 below.

Figure 4.1: Photograph of GDI drill rig used during the investigations.

4.2 General

The soils investigations were carried out in July 2017 and the scope of work was completed in accordance with 'Contract of Topographical Survey and Soil Explorations' – presented in Appendix A. All machine boreholes were terminated at a maximum depth of 20 m.

The following tasks were completed for the soils investigations:

- Site 1:
  - 2 No. hand augered boreholes (HA1-HA2) to 0.87m below existing ground level;
  - 9 No. Scala penetrometer tests (SC01-SC09) to 1.2m below existing ground level;
  - 1 No. machine borehole (BH1) to 20m below existing ground level; with
  - SPTs at regular intervals.
- Site 2:
  - 1 No. machine borehole (BH2) to 20m below existing ground level; with
  - SPTs at regular intervals.

The subsections below present a summary of the investigation work and laboratory test results. A geotechnical investigation site plan is presented in Appendix C, hand auger logs, Scala penetrometer logs and machine borehole logs are presented in Appendix D.

4.3 Hand Auger and Scala Penetrometer Investigations

The hand auger borehole and Scala penetrometer test investigations were carried out on the 27-28 June 2017 at the site. The subsurface soils were described in accordance with NZ Geotechnical Society guidelines and shear strengths are recorded on the hand auger borehole logs presented in Appendix D.

The Scala penetrometer tests were applied in accordance with NZS 4402: 1986 Test 6.5.2. The tests were terminated when the penetration had reached refusal (30 blows per 100 mm). Scala penetrometer test logs are presented in Appendix D.

4.4 Machine Borehole Investigations

The machine borehole investigations were undertaken over a period of 2 days (27 July – 28 July 2017) at the site. The subsurface soils were described in accordance with NZ Geotechnical Society guidelines and shear strengths are recorded on the summary logs presented in Appendix D. Standard Penetration Testing (SPT) was conducted in the boreholes within cohesive materials and the Suva Marl bedrock.

5 Subsurface Conditions

5.1 Geological Setting

Published Geological information[2] suggests the site is underlain by Suva Marl of Miocene age. Observations on site confirmed the presence of Suva Marl within 0.4 m depth of the existing ground level. Suva Marl was also observed in road cuttings and natural outcrops immediately downslope of the proposed sites. A map of the local geology is shown in Figure 5.1 below.

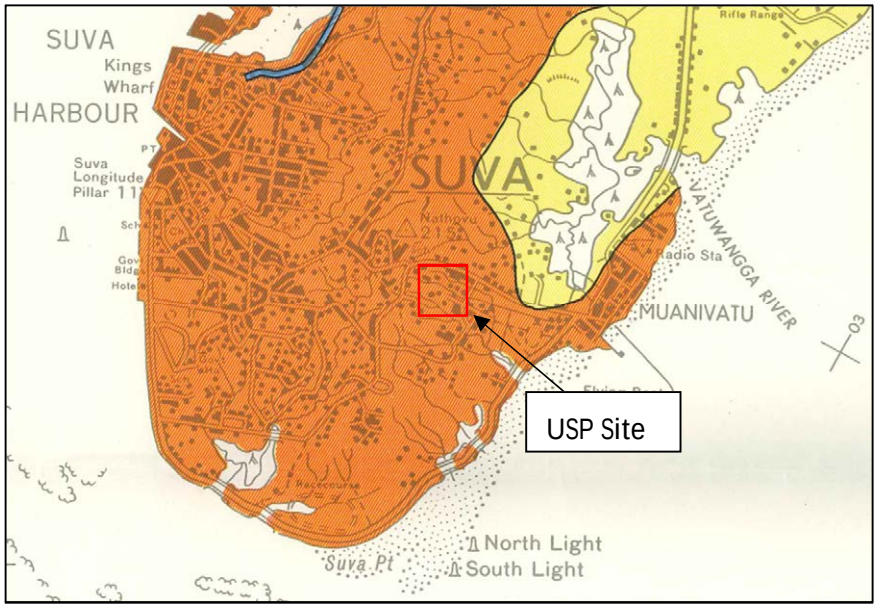

Figure 5.1: Published Geology of the Suva area- Ibbotson (1960). Site shown in red.

[2] Ibbotson,P, 1960, *Geology of the Suva Area, Viti Levu*, Geological Survey Department, Suva, Fiji,

5.2 Ground and Groundwater Conditions

5.2.1 Site 1: BH1

The subsurface conditions for the preferred antenna location (BH1) are summarised in Table 5.1. The investigations extended to the target depth of 20m below ground level. Groundwater was encountered at 13.77m below ground level (RL 16.2m).

Table 5.1: BH1 - Summary of ground conditions

Depth (Below existing ground level)	Geological Unit	Soil Description	Typical SPT 'N' value
0.0-0.30m	Topsoil	Organic SILT with some clay and trace gravel; dark brown. Stiff, moist, moderate plasticity.	-
0.30-2.75m	Highly to Completely Weathered Suva Marl	Highly to completely weathered, light brown, massive SILTSTONE. Very weak.	20-50+
2.75-5.15m	Moderately to Highly Weathered Suva Marl	Moderately to highly weathered, light brown, massive SILTSTONE. Very weak.	50+
5.15-9.1m	Moderately to Highly Weathered Suva Marl	Moderately to highly weathered, light brown, massive MUDSTONE. Extremely weak to very weak.	21-41
9.1-9.55m	Highly Weathered Suva Marl	Highly weathered, light brown, massive SILTSTONE. Extremely weak. (SILT with minor sand; light brown. Very stiff, moist, non-plastic).	23
9.55-11.75m	Moderately Weathered Suva Marl	Moderately weathered, dark greenish grey, massive SILTSTONE. Extremely weak to very weak.	23-27
11.75-17m	Moderately Weathered Suva Marl	Moderately weathered, dark greenish grey, massive SILTSTONE. Very weak.	49-50+
17-20m	Slightly to Moderately Weathered Suva Marl	Slightly to moderately weathered, dark greenish grey massive SILTSTONE. Extremely weak to very weak. Widely spaced joints.	31-49

5.2.2 Site 2: BH2

The subsurface conditions for the secondary preferred antenna location (BH2) are summarised in Table 5.2. The investigations extended to the target depth of 20m below ground level. Groundwater encountered at 10.2m below ground level (RL 12.9m).

Table 5.2: BH2 - Summary of ground conditions

Depth (Below existing ground level)	Geological Unit	Soil Description	Typical SPT 'N' value
0.0-0.45m	Topsoil	Organic SILT; dark brown. Very stiff, moist, low plasticity.	-
0.45-2.75m	Completely weathered Suva Marl	SILT with minor sand; light yellowish brown. Hard, moist, non-plastic.	19
2.75-3.3m	Highly Weathered Suva Marl	Highly weathered, dark grey, massive SILTSTONE. Extremely weak.	42
3.30-4.15m	Moderately Weathered Suva Marl	Moderately weathered, dark grey, massive SILTSTONE. Very weak.	50+
4.15-4.9m	Highly Weathered Suva Marl	Highly weathered, dark brown streaked light brown, massive SILTSTONE. Extremely weak.	30
4.9-7.2m	Slightly to Moderately Weathered Suva Marl	Slightly to moderately weathered, dark grey, interbedded massive SILTSTONE and MUDSTONE. Very weak.	50+
7.2-10.7m	Moderately Weathered Suva Marl	Moderately weathered, dark greenish grey, massive SILTSTONE and MUDSTONE. Extremely weak.	16-30
10.7-15.5m	Moderately Weathered Suva Marl	Moderately weathered, dark grey, massive SILTSTONE. Extremely weak to very weak.	29-45
15.5-18.5m	Slightly Weathered Suva Marl	Slightly weathered, dark grey, massive SILTSTONE. Very weak.	50+
18.5-20m	Slightly to Moderately Weathered Suva Marl	Slightly to moderately weathered, dark greenish grey, massive SILTSTONE. Extremely weak to very weak.	24

6 Geotechnical Laboratory Testing Results

The following laboratory testing has been performed on core samples and SPT samples recovered during the soils investigations. The full set of laboratory testing results are shown in Appendix E. The results of Unconfined Compressive Strength tests are presented in Table 6.1, Atterberg Limits and Water Content presented in Table 6.1, and Density of Soil Particles presented in Table 6.3.

Table 6.1: Laboratory testing summary – UCS testing

Machine Borehole No.	Sample Depth (m)	Unconfined Compressive Strength (kPA)	Modulus of Elasticity (MPa)	Bulk Density (t/m3)
1	2.55-2.75	2021	161	1.58
1	4.70-4.90	1927	438	1.62
1	6.30-6.50	2946	1019	1.57
1	9.95-10.15	2918	961	1.56
1	13.20-13.57	3616	991	1.75
1	14.95-15.20	2270	512	1.61
1	15.95-16.17	3988	419	1.64
1	17.75-17.95	5028	1376	1.68
1	19.58-19.80	2552	703	1.59
2	4.05-4.25	2904	477	1.65
2	6.50-6.76	1676	261	1.56
2	8.50-8.75	1363	76	1.56
2	13.74-14.00	2361	568	1.58
2	14.60-14.80	2287	362	1.62
2	16.20-16.50	2315	393	1.62
2	17.58-17.80	1502	291	1.62
2	17.95-18.25	2378	510	1.59
2	19.44-19.88	2566	678	1.62

Table 6.2: Laboratory testing summary – Atterberg Limits and Water Content

Machine Borehole No.	Sample Depth (m)	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
1	2.75-3.20	63.3	111	62	49
1	5.0-5.45	70.9	121	69	52
1	7.25-7.70	75.7	125	64	61
1	8.75-9.20	85.1	-	-	-
1	10.25-10.70	75.6	-	-	-
1	11.0-11.45	75.1	118	58	60
1	15.5-15.95	-	110	54	56
1	14.0-14.05	58.1	-	-	-
1	17.0-17.45	67.8	-	-	-
2	2.75-3.20	66.1	107	63	44
2	6.5-6.95	74.1	114	56	58
2	7.25-7.70	73.8	149	60	89
2	11.0-11.45	66.9	112	63	49
2	14.0-14.45	68.9	107	53	54

Table 6.3: Laboratory testing summary – Density of Soil Particles

Machine Borehole No.	Sample Depth (m)	Density of Soil Particles (t/m^3)
1	1.0-1.45	2.85
1	3.5-3.92	2.74
1	6.5-6.95	2.8
1	8.0-8.45	2.82
1	9.5-9.95	2.8
1	11.75-12.15	2.79
1	15.5-15.95	2.78
1	18.5-18.95	2.8
2	1.0-1.45	2.83
2	3.5-3.86	2.65
2	6.5-6.95	2.66
2	8.0-8.45	2.8
2	9.5-9.95	2.79
2	11.75-12.2	2.8
2	15.5-15.91	2.8
2	18.5-18.95	2.84

7 Discussion and Engineering Properties

7.1 Site Seismic Classification

7.1.1 General

It is appropriate to design the foundations and structure in accordance with the New Zealand Standard NZS 1170.5:2004[3] which is adopted in Fiji. From the geotechnical investigations undertaken we consider that the site should be classified as a Class B - (Rock).

7.1.2 Importance Level

In accordance with NZS 1170.0:2004 which is adopted in Fiji we have completed this assessment on the basis that the proposed development will be an Importance Level 2 structure. If this is changed during detailed design then updates will be required to this report.

7.1.3 Peak Ground Acceleration

The probabilistic earthquake hazard assessment for Fiji prepared by Jones[4] provides recommendations with respect to estimated ground accelerations. Peak ground accelerations (PGAs) expected from the design earthquakes under serviceability limit state (SLS) and ultimate limit state (ULS) conditions are presented in Table 7.1 below.

Table 7.1: Design Peak Ground Accelerations

Design Life (years)[1]	Serviceability Limit State (SLS)		Ultimate Limit State (ULS)	
	Return Period	Peak Ground Accelerations (g)	Return Period	Peak Ground Accelerations (g)
50	1 in 25 years	0.07	1 in 500 years	0.28

Note:

1. Design Life to be confirmed by the structural engineer/architect as appropriate. If different from that assumed, or if this changes during the project life then these values and the opinions in this report may require reviewing and amending as and where necessary.

[3] NZS 1170.5: 2004 *Structural design actions – Earthquake Actions (New Zealand).* SANZ.
[4] Jones, T, 1997, *Probabilistic Earthquake Hazard Assessment for Fiji*, AGSO, Canberra, Australia,

7.2 Preliminary Geotechnical Engineering Parameters

Geotechnical engineering parameters for Site 1 and Site 2 are detailed in Table 7.2 and Table 7.3 respectively. Parameters have been assigned based on the results of in situ testing and our knowledge of Suva Marl.

Table 7.2: Site 1 – Preliminary Geotechnical Engineering Parameters

Depth (Below existing ground level)	Soil Description	Unit Weight (kN/m^3)	Undrained Shear Strength, Cu (kPa)	Effective Cohesion, c' (kPa)	Effective Internal Friction Angle, ϕ (deg)
0m	Organic SILT with some clay and trace gravel; dark brown. Stiff, moist, moderate plasticity.	18	N/A	2	25
0.3m	Highly to completely weathered, light brown, massive SILTSTONE. Very weak.	18	-	5	28
2.75m	Moderately to highly weathered, light brown, massive SILTSTONE. Very weak.	18	-	5	28
5.15m	Moderately to highly weathered, light brown, massive MUDSTONE. Extremely weak to very weak.	18	-	5	28
9.1m	Highly weathered, light brown, massive SILTSTONE. Extremely weak. (SILT with minor sand; light brown. Very stiff, moist, non-plastic).	18	-	5	28
9.55m	Moderately weathered, dark greenish grey, massive SILTSTONE. Extremely weak to very weak.	19	-	5	28
11.75m	Moderately weathered, dark greenish grey, massive SILTSTONE. Very weak.	19	-	15	30
17m	Slightly to moderately weathered, dark greenish grey massive SILTSTONE. Extremely weak to very weak. Widely spaced joints.	19	-	15	30

Table 7.3: Site 2 – Preliminary Geotechnical Engineering Parameters

Depth (Below existing ground level)	Soil Description	Unit Weight (kN/m^3)	Undrained Shear Strength, Cu (kPa)	Effective Cohesion, c' (kPa)	Effective Internal Friction Angle, ϕ (deg)
0m	Organic SILT; dark brown. Very stiff, moist, low plasticity.	18	N/A	2	25
0.45m	SILT with minor sand; light yellowish brown. Hard, moist, non-plastic.	18	10	5	28
2.75m	Highly weathered, dark grey, massive SILTSTONE. Extremely weak.	18	-	5	28
3.3m	Moderately weathered, dark grey, massive SILTSTONE. Very weak.	18	-	5	28
4.15m	Highly weathered, dark brown streaked light brown, massive SILTSTONE. Extremely weak.	18	-	5	28
4.9m	Slightly to moderately weathered, dark grey, interbedded massive SILTSTONE and MUDSTONE. Very weak.	18	-	5	28
7.2m	Moderately weathered, dark greenish grey, massive SILTSTONE and MUDSTONE. Extremely weak.	18	-	5	28
10.7m	Moderately weathered, dark grey, massive SILTSTONE. Extremely weak to very weak.	19	-	15	30
15.5m	Slightly weathered, dark grey, massive SILTSTONE. Very weak.	19	-	15	30
18.5m	Slightly to moderately weathered, dark greenish grey, massive SILTSTONE. Extremely weak to very weak.	19	-	15	30

7.3 Foundation Design

We consider shallow foundations would be suitable for the proposed parabolic antenna structures. The bearing capacities presented in Table 7.4 can be used for the design of shallow foundations. Any shallow foundations should be embedded a minimum of 600mm below existing ground level.

Table 7.4: Shallow Foundation Design Parameters for Sites 1 and 2

Location	Material Type	Bearing Capacity		
		Geotechnical Ultimate	Ultimate Limit State Design (1)	Working Load Design
Site 1	Highly weathered SILTSTONE (BH1: >0.3m depth)	2000 kPa	1000 kPa	670 kPa
Site 2	SILT with minor sand (BH2: 0.45m-2.75m depth)	600 kPa	300 kPa	200 kPa
	Highly weathered SILTSTONE (BH2: >2.75m depth)	2000 kPa	1000 kPa	670 kPa

1. NZ Building Code – B1/VM4: Ultimate limit state bearing capacity pressure (ULS structural loads) using $\phi g = 0.5$

The selection of an appropriate foundation type will depend upon the structural loads and the settlement tolerances. For instance, uplift loads under a seismic load case will most likely necessitate the use of either pile foundations or ground anchors. Based on a review of laboratory test results, the end-bearing and skin friction capacities presented in Table 7.5 can be used for the design of piled foundations. Piles are to be founded "3B" (B=pile diameter) below a depth of 2.75m.

Table 7.5: Deep Foundation Design Parameters for Sites 1 and 2

Location	Material Type	Parameter	Geotechnical Ultimate	Ultimate Limit State Design	Working Load Design
Site 1 and 2	Moderately to Highly weathered SILTSTONE (BH1: >2.75m depth) (BH1: >2.75m depth)	End-bearing[1]	6 MPa	3 MPa	2 MPa
	Moderately to Highly weathered SILTSTONE (BH1: >2.75m depth) (BH1: >2.75m depth)	Skin friction[2]	400 kPa	265 kPa	200 kPa

Should grouted anchors be required, we recommend anchors are embedded into the underlying moderately to highly weathered (or better) Siltstone, present from 2.75m depth at both Site 1 and Site 2. Preliminary skin friction capacities for ground anchors are presented in Table 7.6.

Table 7.6: Ground Anchor Design Parameters for Sites 1 and 2

Location	Material Type	Skin Friction Capacity		
		Geotechnical Ultimate	Ultimate Limit State Design	Working Load Design
Site 1 and 2	Moderately to Highly weathered SILTSTONE (BH1: >2.75m depth) (BH1: >2.75m depth)	400 kPa	265 kPa	200 kPa

8 Applicability

This report has been prepared for the exclusive use of our client Yachiyo Engineering Co.,Ltd., with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor International Ltd

Report prepared by:

.....

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Eng Geologist + Geotech Engineer

Authorised for Tonkin & Taylor International Ltd by:

.....

Chris Freer

Project Director

R Bond
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Appendix B: Topographical Survey Results

THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI

(approximate)

Survey Conducted 27 - 28 June 2017, using:

Sokkia Total Station (Reflectorless)
Model: SET4130R13
Serial Number: 145240

399800mE 399900mE 400000mE 400100mE

800010mN 800000mN 799990mN 799980mN 799970mN

SITE 1

SITE 2

RN1 RN2 RN3 RN4

BH1 BH2

IS1 IS2 IS3

Refer Enlargement at Left

Corner of ICT building

SURVEY MARK SCHEDULE

Name	Northing (m)	Easting (m)	RL (m)
RN1	800000.00	400000.00	29.70
RN2	800022.88	400108.47	23.46
RN3	800016.77	400155.26	22.18
RN4	799921.57	400052.32	24.22
IS1	799959.08	400010.89	28.14
IS2	799981.01	399977.71	30.11
IS3	800028.37	400132.05	22.93

LEGEND

- Building Footprint
- Roof Area
- Road (Chip Seal)
- Major Contour (with height)
- Minor Contour (0.2m vertical interval)
- Skyline Vegetation Measurement Point
- Survey Mark
- Ground Test Location (HA, SC)
- Edge of Dense Vegetation (approximate)
- Borehole Location (BH, supplied by others)
- Tree (isolated, at approximate size)

SC1 SC2 SC3 SC5 SC6 SC7 SC8 HA1 HA2

Bin Pad
Water Tanks
Pump Shed
Fire Hydrant
Old Lamp Base
Shipping Container
Roof Tanks
Surface Stormwater Drain
Comms Shed
Satellite Dish

ENLARGEMENT
Scale 1:125 (A1)
Scale 1:250 (A3)

Vanua Levu
Taveuni Island
Lautoka
Ba
Vatukoula
Nadi
Viti Levu
Momi
Sigatoka
Suva
See Location Plan B
FIJI
Kadavu Island

LOCATION PLAN A
(not to scale)

Suvavou Village
Princess Rd
Mead Rd
Kings Rd
Raiu Dovi Rd
Suva
Edinburgh Dr
Reeva St
Cakl Rd
Brown St
Granthams Rd
Fletcher Rd
Albert Park
Laucala Bay Rd
Site Plan
Park
Vuya Rd
Queen Elizabeth Rd

LOCATION PLAN B
(not to scale)

SURVEY DATUM: ASSUMED
Bearing Origin - Approximate, via hand-held GPS, estimated error +/-2°
Coordinate Origin - RN1, assumed as 800000mN, 400000mE
(Approximate RN1 position: E178°26'32.3" S18°08'50.1" - WGS84,
or 1967429mE 3873015mN - Fiji Geodetic Datum 1986)

HEIGHT DATUM: As Per ICT BUILDINGS ASBUILT (supplied by others)
(Height Origin: ICT Buildings Fourth Floor Level, RL =27.95m)

Revision	Description	Date
C	Enlargement Area Modified as per Client Request	04 Sep 2017
B	Borehole Locations Added, Minor Additions and Improvements	02 Aug 2017
A	For Information	July 2017

Approval

Client

Tonkin+Taylor

Drawn: ES
Designed:
Surveyed: ES/MO
Project: Fiji2017

Scale: 1:500 (A1) 1:1000 (A3)

Title: Site Topographical Plan Proposed USPnet Installation University of South Pacific Laucala Campus, Suva, FIJI

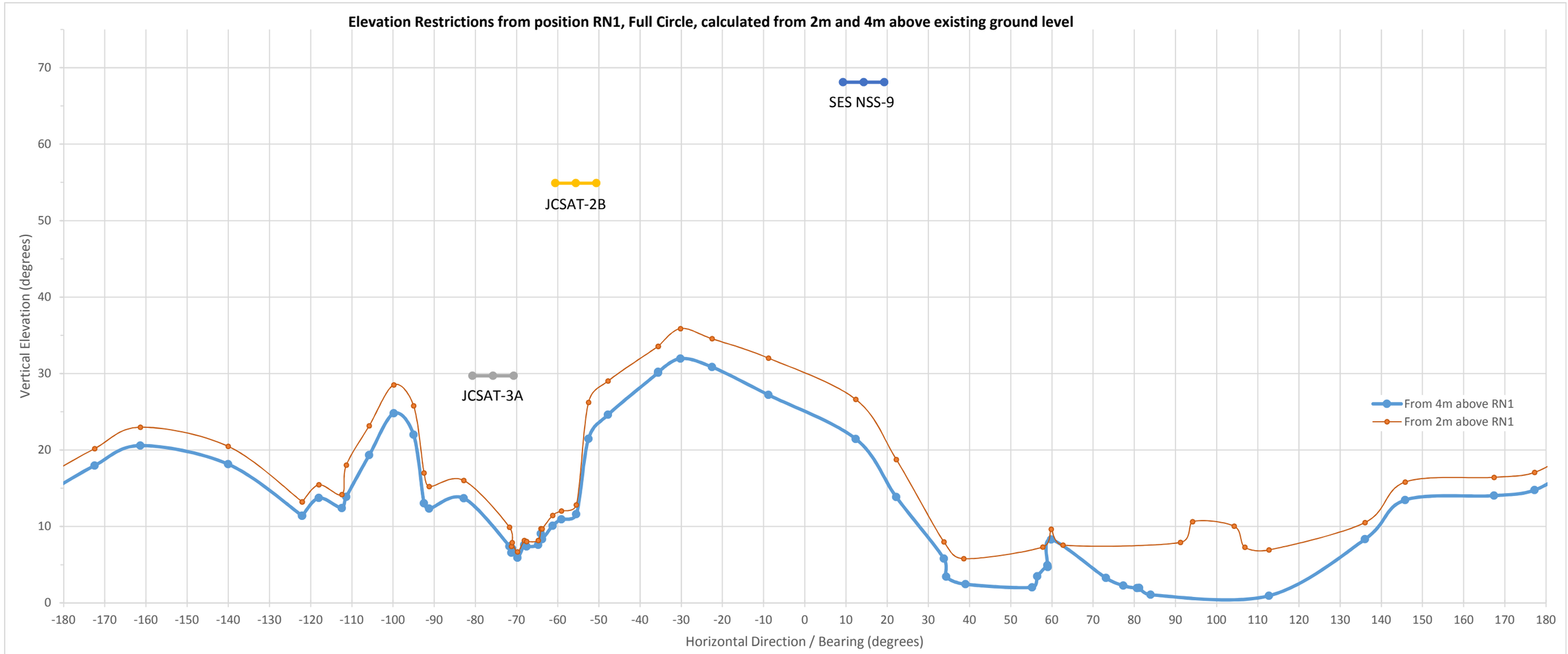
Dwg. No. T01
Job No. 17010
Revision C

Date Plotted: Mon Sep 04 13:07:56 2017

A-6-19

THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI

UNIVERSITY OF SOUTH PACIFIC, Laucala Campus, Site 1,



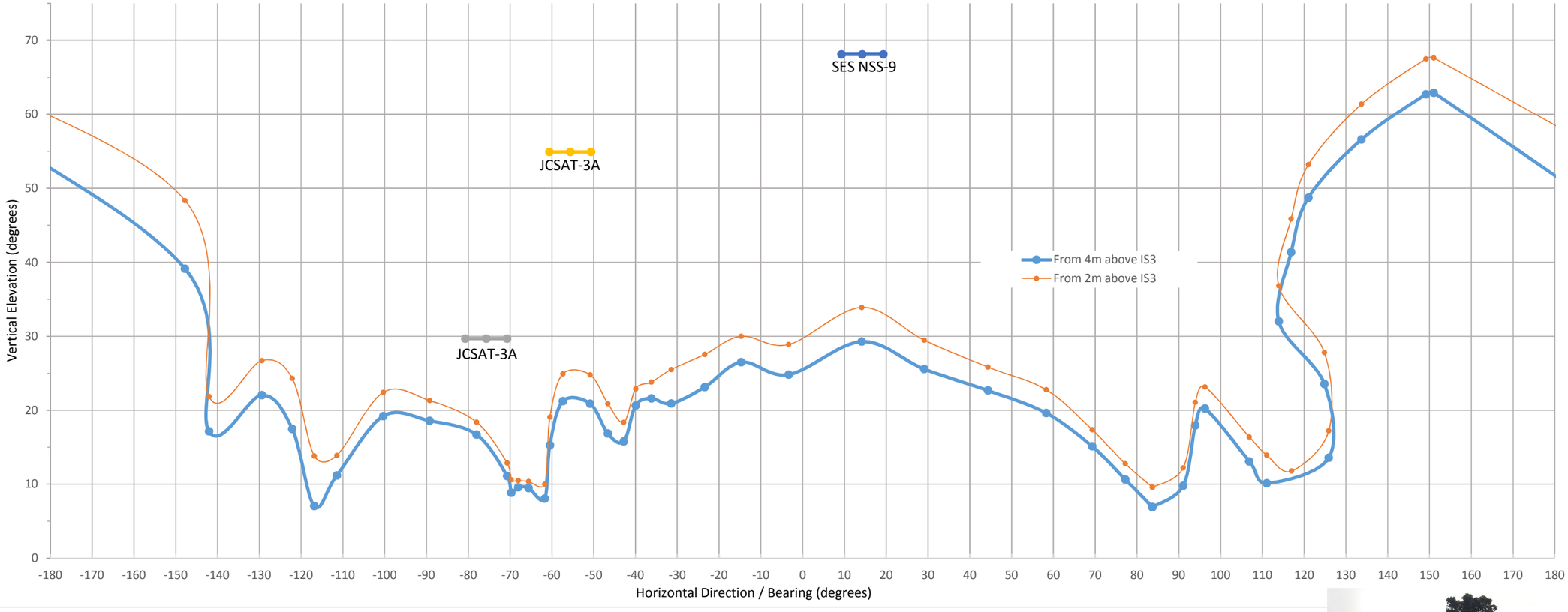
Satellites shown at nominal locations, with +/-5° variation in horizontal direction (since measurement bearing origin was inexact)

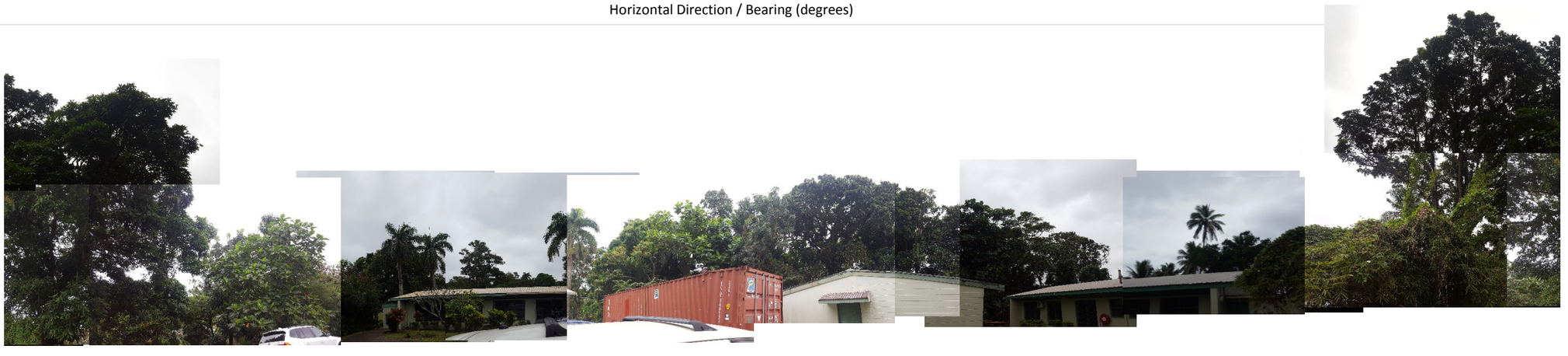
Photographs of existing restrictions shown beneath radial plot. Note, some restricting trees are not visible behind existing building in foreground.

THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI

UNIVERSITY OF SOUTH PACIFIC, Laucala Campus, Site 2,

Elevation Restrictions from position IS3, Full Circle, calculated from 2m and 4m above existing ground level





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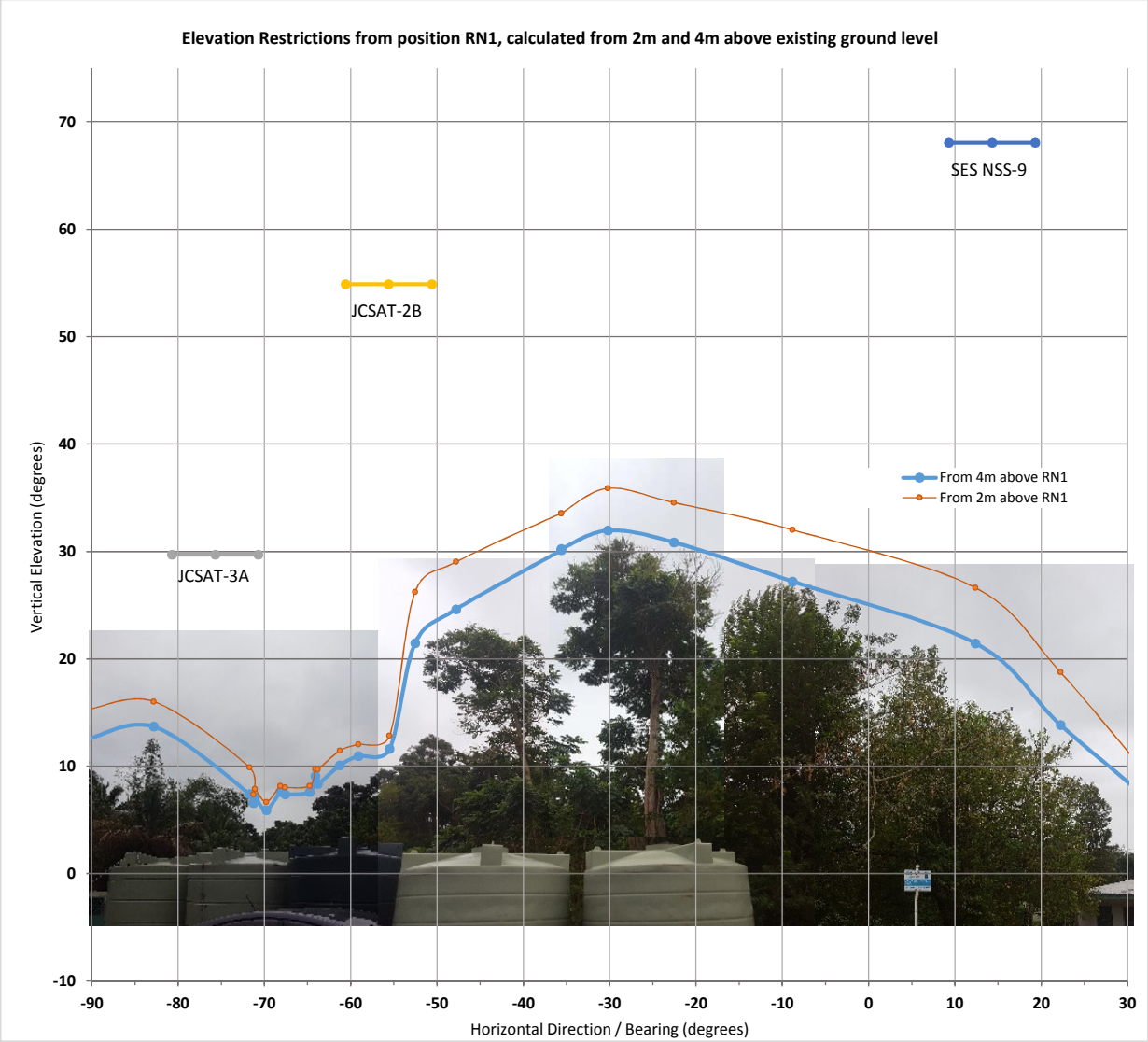
THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI

UNIVERSITY OF SOUTH PACIFIC, Laucala Campus, Site 1,



Satellites shown at nominal locations, with +/-5° variation in horizontal direction (since measurement bearing origin was inexact)

Photographs of existing restricting vegetation shown approximately in correspondence with measured restriction locations.

Appendix C: Geotechnical Investigation Site Plan

THE PROJECT FOR ENHANCEMENT OF USPNet COMMUNICATION SYSTEM IN THE REPUBLIC OF FIJI

(approximate)

Survey Conducted 27 - 28 June 2017, using:

Sokkia Total Station (Reflectorless)
Model: SET4130R13
Serial Number: 145240

399800mE 399900mE 400000mE 400100mE

800000mN

799900mN

SITE 1

SITE 2

RN1 RN2 RN3 RN4

BH1 BH2

IS1 IS2 IS3

Refer Enlargement at Left

Corner of ICT building

Comms Shed

Satellite Dish

LEGEND

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ENLARGEMENT
Scale 1:125 (A1)
Scale 1:250 (A3)

SC1 SC2 SC3 SC5 SC6 SC7 SC8 HA1 HA2 RN1

Bin Pad
Water Tanks
Pump Shed
Fire Hydrant
Old Lamp Base
Shipping Container
Roof Tanks
Surface Stormwater Drain

800010mN 800000mN 799990mN 799980mN 799970mN
399990mE 400000mE 400010mE

LOCATION PLAN A
(not to scale)

Vanua Levu
Taveuni Island
Lautoka
Ba
Vatukoula
Nadi
Momi
Viti Levu
Sigatoka
Suva
See Location Plan B
FIJI
Kadavu Island

LOCATION PLAN B
(not to scale)

Suvavou Village
Princess Rd
Kings Rd
Raiu Dvr Rd
Mead Rd
Suva
Edinburgh Dr
Reeva St
Cali Rd
Brown St
Granthams Rd
Fletcher Rd
Albert Park
Laucala Bay Rd
Site Plan
Park
Vitra Rd
Queen Elizabeth Rd

Revision	Description	Date
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Approval

Client: Tonkin+Taylor

Drawn: ES
Designed:
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Scale: 1:500 (A1) 1:1000 (A3)

Title: Site Topographical Plan Proposed USPnet Installation University of South Pacific Laucala Campus, Suva, FIJI

Dwg. No. T01
Job No. 17010
Revision C

Date Plotted: Mon Sep 04 13:07:56 2017

A-6-24