

Short Term Action Plan for the USPNet Enhancement

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1. Targets

This Action Plan aims at the targets below as a first step towards the “Medium to Long Term Plan for the USPNet Enhancement”.

- Services Integration on IP Platform (Video, Audio Data and Tel/Fax)
- Improvement of Video Bandwidth utilization
- Improvement of USPNet reliability
- Expansion of Internet connection Bandwidth
- Survey on Expansion of USPNet service area

2. Solutions for Targets

In order to achieve the targets, the following tasks shall be carried out to provide the solutions for targets. These solutions have some experimental elements for establishing the firm ground towards the way forward. The functionality of integrated services on IP platform will be confirmed between Suva and Lautoka/Vanuatu. After successful confirmation of functionality, the service integration will be implemented at every USPNet site. On completion of the Action Plan, all the USPNet sites will enjoy the wider connection to Suva, the improved reliability of satellite network and the flexible scheduling of Video lectures.

- Adoption of this Action Plan by the USP Management
 - ① This is the first very important step forward, as the Action Plan can only be carried out with the full support and commitment of the USP management.
- IP readiness confirmation
 - ① Procurement of trial equipment
(Example list of equipment;
Cisco 2600/3600 series Multimedia Access Routers

Cisco7815-1000/7825-1133 Media Convergence Server

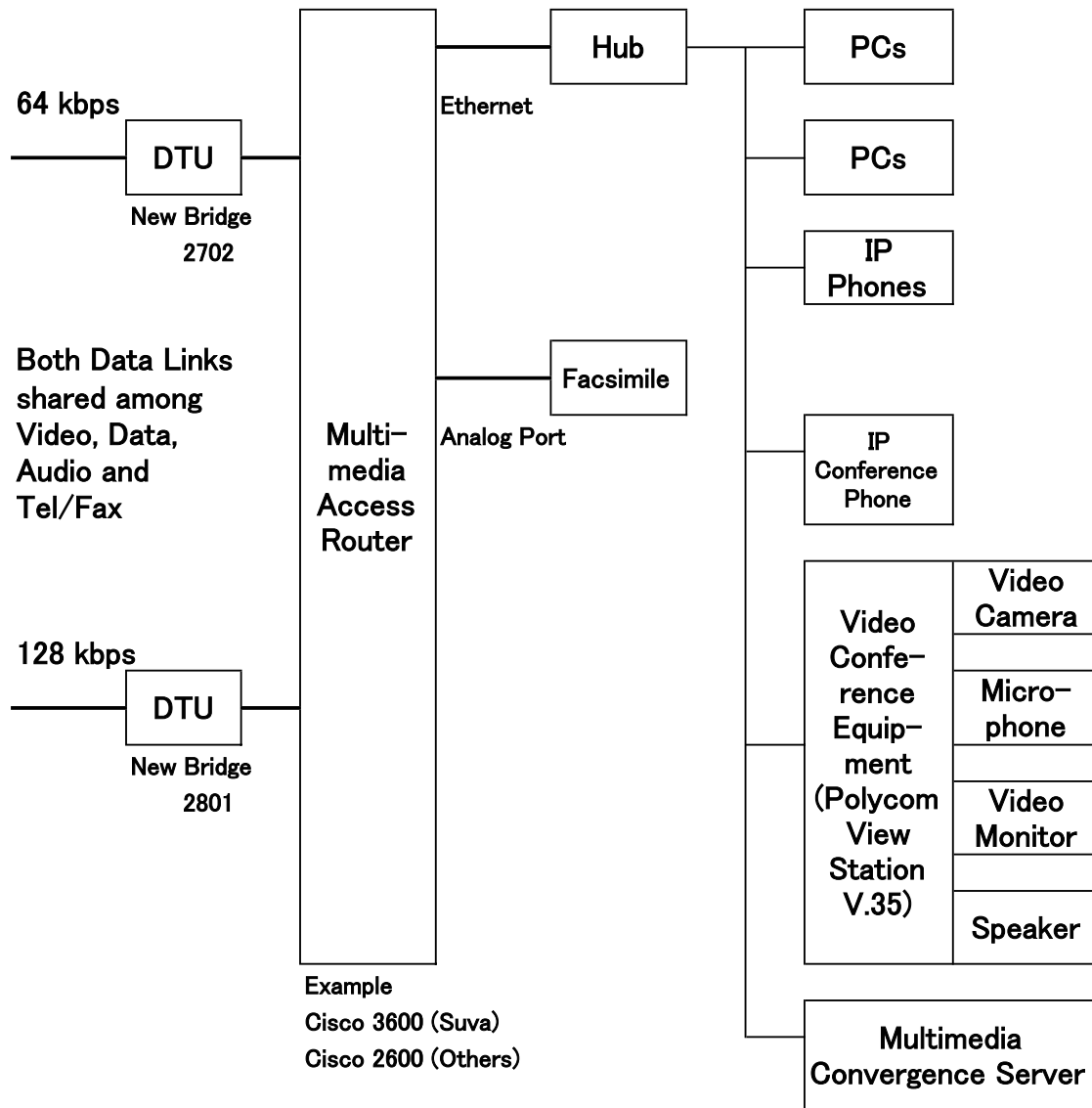
(With Call Manager software)

Cisco IP Conference Station 7935 for Audio Tutorial

Cisco IP Phone 7910)

- ② Installation of trial equipment at Laucala for leased line trial
Installation of the above equipment and activation of DHCP server at Laucala. ([See Figure 1-1 and Figure 1-2](#))
- ③ Temporary installation of trial equipment at Raiwaqa for Acceptance Tests
Temporary installation of the above equipment and activation of DHCP server at Raiwaqa. ([See Figure 1-1 and Figure 1-2](#))
Equipment Acceptance Test between Laucala and Raiwaqa to confirm functionality of IP Phone, IP Conference Phone and Facsimiles over Multimedia Access Routers through 64 kbps leased line connection.
De-install the equipment from Raiwaqa for relocation to Lautoka. The equipment configuration at Raiwaqa should be restored same as the existing configuration.
- ④ Installation of trial equipment at Lautoka for leased line trial
Installation of the above equipment and activation of DHCP server at Lautoka ([See Figure 1-1 and Figure 1-2](#))
- ⑤ Trial of Multimedia IP connection between Laucala and Lautoka
For the trial, both 64 kbps and 128 kbps links are used to connect two Multimedia routers at Laucala and Lautoka. The trial should include the services such as Video conferencing, Audio conferencing, Telephone call and Data communications over Multimedia routers. The evaluation criteria of the trial results shall be established prior to the trial and the results shall be evaluated with reference to the criteria established. If the results are not satisfactory, remedial action shall be taken and the trial shall be repeated.
- ⑥ Installation of trial equipment for satellite link trial
Installation of the trial equipment and activation of DHCP server at Vanuatu ([See Figure 1-1 and Figure 1-2](#))
- ⑦ Trial of Multimedia IP connection between Laucala and Vanuatu
For the time of trial, a temporary 128 kbps two-way link between Laucala and Vanuatu shall be set up and both existing 64 kbps and temporary 128 kbps links are used to connect two Multimedia routers at Laucala and Vanuatu. The trial should include the services such as Video conferencing, Audio conferencing, Telephone call and Data communications

Figure 1-2 Trial Equipment Configuration



Example
Cisco 3600 (Suva)
Cisco 2600 (Others)

Example
Cisco 7825 (Suva)
Cisco 7815 (Samoa/Vanuatu)
All other sites use Suva server.

over Multimedia routers. The evaluation criteria of the trial results shall be established prior to the trial and the results shall be evaluated with reference to the criteria established. If the results are not satisfactory, remedial action shall be taken and the trial shall be repeated.

- Leased Line Video Bandwidth Utilization

- ① Procurement and Installation of IP equipment for Labasa and Raiwaqa
Same equipment as installed at Lautoka for the trial shall be procured and installed at these two sites.
- ② Combined use of 64kbps and 128 kbps leased lines with Multimedia Access routers (Laucala –Labasa)
- ③ Aggregation of two leased lines (64 kbps and 128 kbps) to a single higher speed leased line (512 kbps) for Laucala-Lautoka and Laucala-Labasa links. The total recurrent cost will decrease, while the total Data Rate will increase by more than twice. This saving can buy a 256 kbps Bandwidth data link with Raiwaqa. (See cost implications) [\(See Figure 2\)](#)

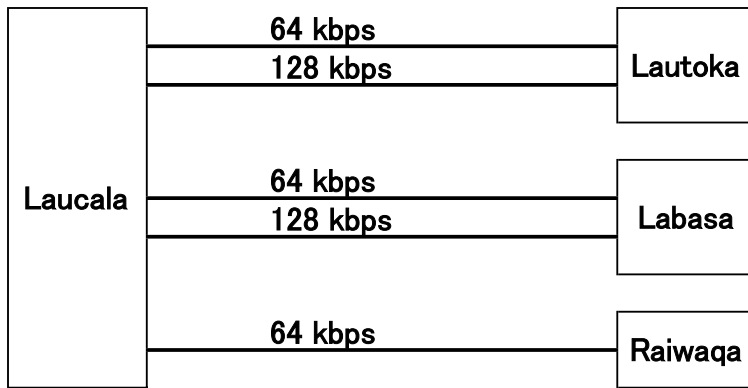
- Satellite Link Bandwidth Aggregation

- ① Procurement of IP equipment for Samoa and all of nine Remote Earth Station sites. Same equipment as installed at Vanuatu for the trial shall be procured and installed at these two sites.
- ② Due to broadcast Video application, the connection of Video equipment to the Multimedia Access Router shall be carried out in coordinated and synchronized manner at all stations. Once, the Video is transferred on to IP platform along with all other services, the aggregation of satellite links can be started. [\(See Figure 3\)](#)
- ③ The proposed satellite channel aggregation means the transmission plan change, and the coordination with the satellite provider is required.

Earth Station	Current Tx Data Rate	Proposed Tx Data Rate
Fiji Hub Station	64 kbps x 11, 128 kbps ad hoc (Maximum 3 channels)	768 kbps x 1
Mini-Hub Stations (Samoa/Vanuatu)	64 kbps x 1 128 kbps ad hoc	256 kbps x 1
Remote Stations	64 kbps x 1 128 kbps ad hoc	64 kbps x 1 128 kbps ad hoc
Common Pool	128 kbps x4 for ad hoc use by all stations	128 kbps x2 for ad hoc use by Remote stations
Total Data Rate	1920 kbps	2112 kbps

Figure 2 Leased Line Aggregation

Existing Leased Line Configuration



Aggregated Leased Line Configuration

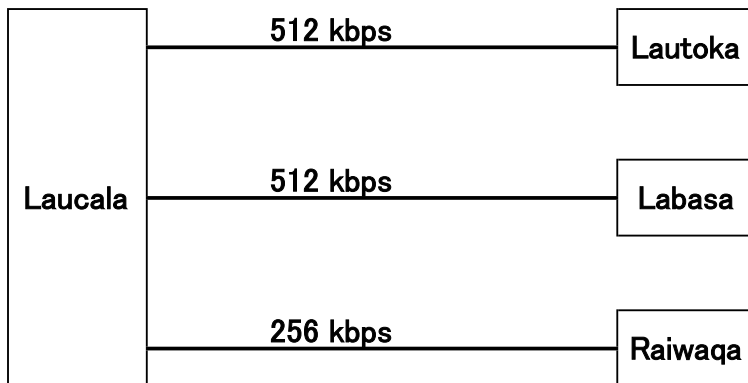
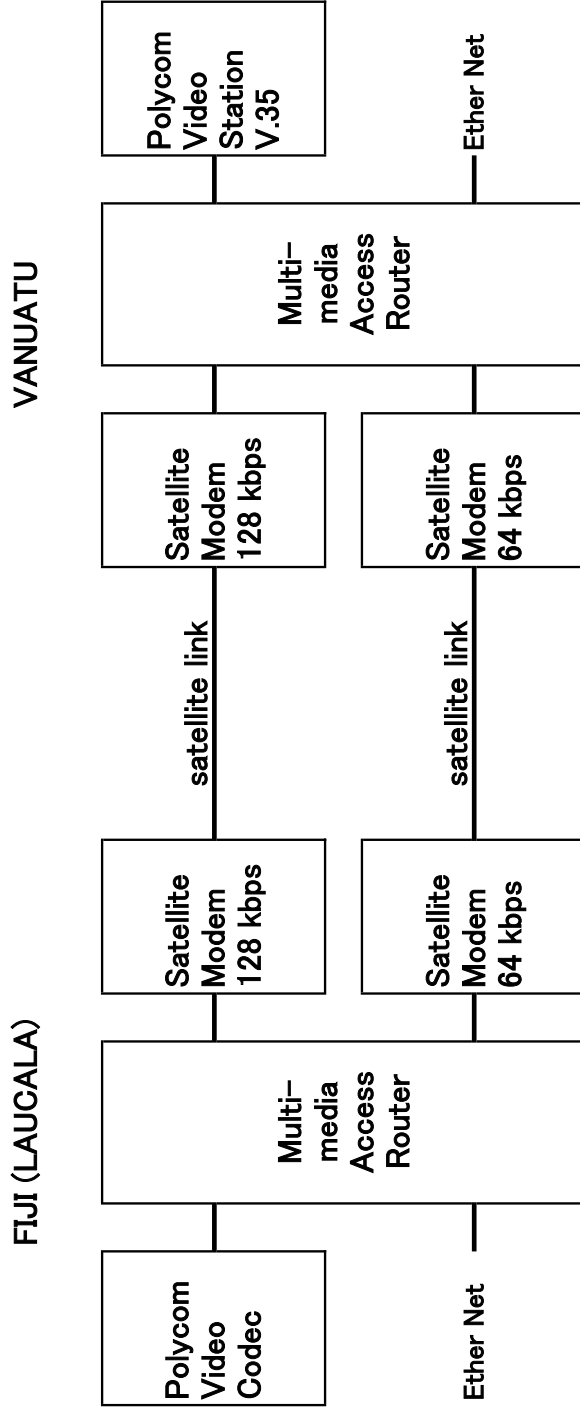


Figure 3 IP based connection of Satellite Links



Note: Considering data communications demand at Mini-Hub station, the data rate for mini-hub is more than simple sum of the existing channels. Hub station data rate is on the contrary less than simple sum, considering traffic averaging effect among Mini-Hub and Remote stations.

- ④ Due to a slight bandwidth increase due to the available equipment bandwidth step, the recurrent satellite capacity cost can also be increased subject to negotiation with the satellite provider.
 - ⑤ The radio station licenses shall also be modified according to new transmission plan prior to actual implementation of it.
 - ⑥ On completion of both Satellite Capacity and Regulatory coordination, the system parameter change can be planned and activated from the Hub station.
- Introduction of Uninterruptible Power Supply (UPS) and Engine Generator for the Hub Earth Station in Suva
 - ① Expansion of Earth Station building ([See Figure 4](#))
 - ② Procurement of Uninterruptible Power Supply
 - ③ Installation of UPS and Engine Generator
 - ④ Reconfiguration of Power Supply ([See Figure 5](#))
 - Expansion of Internet connection Bandwidth
 - ① Survey of possible Options

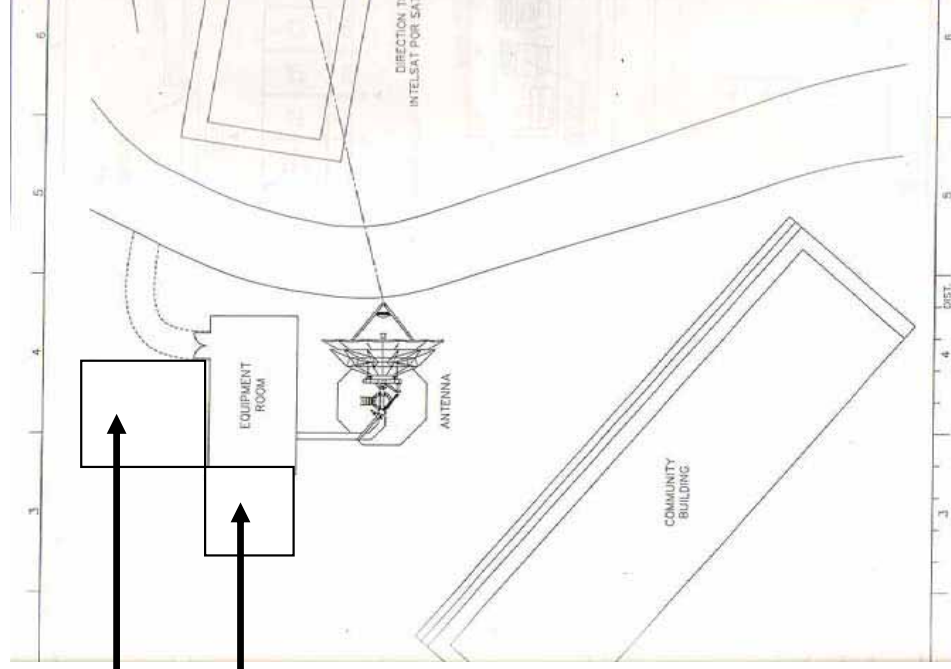
The Internet connection service in Fiji is provided by Connect Ltd. On Monopoly basis and the USP subscribes 512 kbps connection. Alternative measures could be subscribing a gateway service of a provider outside Fiji through the Southern Cross cable network or Intelsat satellite link. However, such alternatives require permission from the telecommunications authority, though it could be obtained as a special case for academic and educational use.
 - ② Regulatory coordination with the Ministry of Communications

The USP shall provide a strong discussion paper seeking a special permission of Telecommunications Authority for Internet connection through an alternative provider outside Fiji. In the paper, the academic and educational benefits, and its good consequences for the USP, Fiji and South Pacific region shall be stressed.

Figure 4 Proposed Building Expansion for USPNet Hub Earth Station

10m x 6m space for store, office, toilet and meeting room

5m x 4m space for Diesel generator and UPS system



PROPOSAL GENERAL NOTES:

1. Building expansion to meet more need for office space, toilet and accommodation for proper UPS system for the Hub earth station.
2. UPS accommodation must be in place **BEFORE** new UPS equipment arrives in Suva (maybe end 2003?).
3. Two blocks of building expansion identified for staff and UPS system.
4. The plan also allows for future expansion of equipment and racks, to be installed in the Hub station.
5. More detailed plan can be discussed with Manager, USPNet.

K. Moala (29th August, 2002)



Figure 5-1 Existing Hub Earth Station Power System

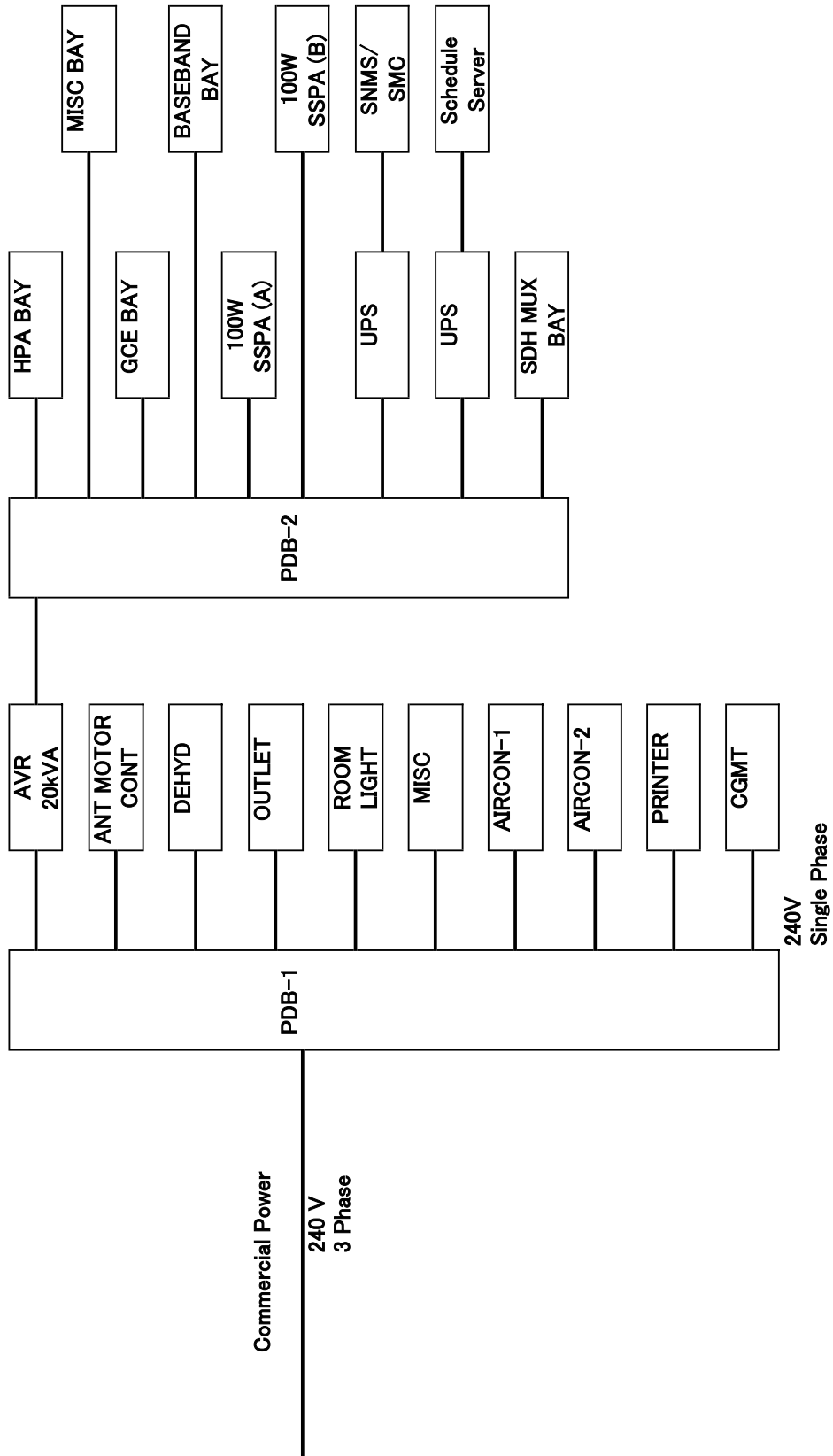
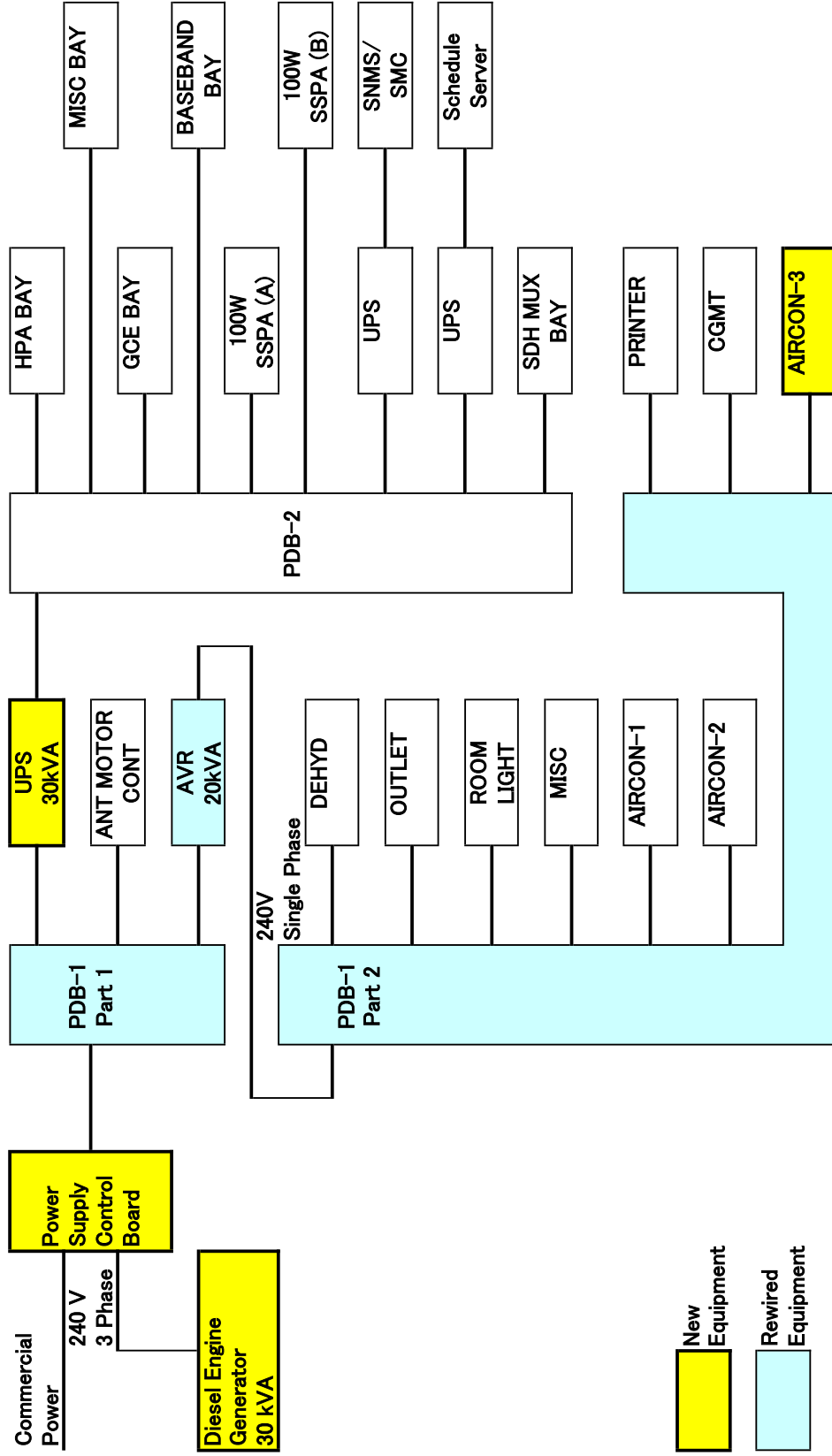


Figure 5-2 Reconfigured Hub Earth Station Power System



- ③ Negotiation with Provider
- ④ Order and Implementation
- Satellite Receiver survey
 - ① Satellite Receive only antenna (Specifications, Cost)
 - ② TV Receive only satellite terminal (Specifications, Cost)
 - ③ Satellite Data receiver (Specifications, Cost)
 - ④ Compatibility study with the USPNet
 - ⑤ Demand against cost study
 - ⑥ Survey Report with Recommendation

3. Conditions

The solutions are based on the following conditions.

- Fluent data flow and data processing in Laucala LAN
- LAN ports available for IP readiness confirmation
- Wiring available between existing Facsimile machine to Multimedia Access Router for functionality confirmation
- IP address available for IP-readiness confirmation
- Utilization of pre-purchased Engine Generator for Earth Station

4. Restrictions

The following restrictions will apply to this Action Plan.

It shall be noted that these restrictions may cause delays in the schedule.

- Fund for procurement of required equipment
- Minimal impact to the existing services
- Fund for expansion of Earth Station building to accommodate Engine Generator and new UPS and PDB
- Minimal outage of Satellite Network for Power Supply re-configuration at Hub Earth Station
- Telecommunications regulations

5. Action Plan

The detailed Action Plan for the solutions and its summary are given in Figure 6 and in the following table, respectively. The summary of this table is given in [Table 1](#).

Target	Solution	Tasks	Responsibility	Completion Date	
IP Readiness Confirmation	Equipment Procurement	Coordinate	Director/ITS	Jan. 24, 2003	
	-Equipment Survey	Survey	Manager/S&N	Nov. 22, 2002	
	-Equipment Specification	Writing	Manager/S&N	Dec. 20, 2002	
	-Funding arrangement	Coordinate	Director/ITS	Dec. 20, 2002	
	Order and Delivery	Purchase	Manager/S&N	Jan. 24, 2003	
	Equipment Installation	Coordinate	Director/ITS	Mar. 7, 2003	
	-Laucala	Install	Manager/S&N	Jan. 31, 2003	
	-Raiwaqa	Install (Temporary)	Manager/S&N	Feb. 4, 2003	
	-Equipment Test	Test	Manager/S&N	Feb. 7, 2003	
	-Lautoka	Install	Manager/S&N	Feb. 14, 2003	
	-Vanuatu	Install	Manager/S&N Mgr/USPNet	Mar. 14, 2003	
	Lease Line Trial	Coordinate	Director/ITS	Feb. 28, 2003	
	-Trial	Carry out	Manager/S&N	Feb. 21, 2003	
	-Evaluation	Review	Manager/S&N	Feb. 27, 2003	
	-Decision to proceed	Decide	Director/ITS	Feb. 28, 2003	
	Satellite Link Trial	Coordinate	Director/ITS	Apr. 11, 2003	
	-Operations Procedures	Write	Manager/S&N Mgr/USPNet	Mar. 28, 2003	
	-Trial	Carry out	Manager/S&N Mgr/USPNet	Apr. 4, 2003	
	-Evaluation	Review	Manager/S&N Mgr/USPNet	Apr. 10, 2003	
	-Decision to proceed	Decide	Director/ITS	Apr. 11, 2003	

Table 1 Summary of Tasks in Solutions for Targets

Targets	Tasks in Solutions
IP Readiness Confirmation	Trial Equipment Procurement
	Trial Equipment Installation
	Leased Line Trial
	Satellite Link Trial
Leased Line Video Bandwidth Utilization	Equipment Procurement
	Equipment Installation
	Aggregation of leased lines
Satellite Link Bandwidth Aggregation	Procurement of IP Equipment
	Equipment Installation
	Transmission Plan Coordination
	System Transition
UPS and Engine Generator Introduction	Procurement of UPS
	Earth Station Building Expansion
	Equipment Installation
	Power Supply Reconfiguration
Expansion of Internet Connection Bandwidth	Funding
	Regulatory Coordination
	Negotiation and Contract with Provider
Satellite Receiver Survey	Survey and Report

Leased Line Video Bandwidth Utilization	Equipment Procurement	Coordinate	Directors ITS	Apr. 25, 2003
	-Funding Arrangement	Coordinate	Directors ITS	Mar. 28, 2003
	-Order and Delivery	Purchase	Manager/S&N	Apr. 25, 2003
	Equipment Installation	Coordinate	Director/ITS	May 9, 2003
	-Raiwaqa	Install	Manager/S&N	May 2, 2003
	-Labasa	Install	Manager/S&N	May 9, 2003
	Aggregation of leased lines	Coordinate	Directors ITS	May 16, 2003
	Coordination with Telco Fiji	Coordinate	Chief Engineer/ITS	Mar. 28, 2003
	Implementation	Implement	Chief Engr/ITS Manager/S&N	May 16, 2003
Satellite Link Bandwidth Aggregation	Procurement of IP Equipmt	Coordinate	Director ITS	Jul. 4, 2003
	-Funding Arrangement	Coordinate	Director ITS	May 9, 2003
	-Order & Deliv	Purchase	Manager/S&N	Jul. 4, 2003
	Equipment Installation	Coordinate	Director ITS	Sep. 26, 2003
	-Installation Procedures	Write	Manager/S&N Mgr/USPNet Video Engineer	May 30, 2003
	-Cook Islands	Install	Mgr/USPNet	Jul. 11, 2003
	-Kiribati	Install	Mgr/USPNet	Jul. 18, 2003
	-Marshall Is.	Install	Mgr/USPNet	Jul. 25, 2003
	-Nauru	Install	Mgr/USPNet	Aug. 1, 2003
	-Niue	Install	Mgr/USPNet	Aug. 8, 2003
	-Samoa	Install	Mgr/USPNet	Aug. 15, 2003
	-Solomon Is.	Install	Mgr/USPNet	Aug. 22, 2003
	-Tokelau	Install	Mgr/USPNet	Sep. 5, 2003
	-Tonga	Install	Mgr/USPNet	Sep. 12, 2003
	-Tuvalu	Install	Mgr/USPNet	Sep. 19, 2003
	-Video transition to IP	Implement	Manager/S&N Mgr/USPNet Video Engineer	Sep. 26, 2003
	Transmission Plan coordin'n	Coordinate	Mgr/USPNet	Aug. 1, 2003
	-Satellite Provider	Coordinate Negotiate	Mgr/USPNet	Jul. 4, 2003
	-Regulations Authority	Coordinate	Mgr/USPNet	Jul. 4, 2003
	-Budget for Recurrent cost	Coordinate	Manager USPNet	Aug. 1, 2003
Sys Transition	Coordinate	Mgr/USPNet	Oct. 31, 2003	
-Plan	Write	Mgr/USPNet	Oct. 24, 2003	
-Transition	Implement	Mgr/USPNet	Oct. 31, 2003	

UPS and Engine Generator Introduction		Coordinate & Implement	Mgr/USPNet	Jun. 11, 2003
	-Equipment Survey	Survey	Mgr/USPNet	Nov. 22, 2002
	-Procurement Specification	Writing	Mgr/USPNet	Dec. 6, 2002
	-Funding Arrangement	Coordinate	Mgr/USPNet	Dec. 20, 2002
	-Earth Station Bld expansion	Coordinate & implement	Mgr/USPNet	Apr. 30, 2003
	-Order and Delivery	Purchase	Mgr/USPNet	May 28, 2003
	-Installation	Install	Mgr/USPNet	Jun. 4, 2003
	-Reconfig. of Power Supply	Implement	Mgr/USPNet	Jun. 11, 2003
Expansion of Internet Connection Bandwidth		Coordinate	Director/ITS	Mar. 14, 2003
	-Survey of Options	Survey	Mgr/USPNet	Nov. 29, 2002
	-Funding Arrangement	Coordinate	Director/ITS	Jan. 31, 2003
	Regulatory Coordination	Coordinate	Chief Engr/ITS	Jan. 31, 2003
	Negotiation with Providers	Negotiate	Chief Engr/ITS	Feb. 28, 2003
	Order and Implement.	Implement	Chief Engr/ITS (Mgr/USPNet)	Mar. 14, 2003
Satellite Receiver Survey		Coordinate	Mgr/USPNet	Dec. 19, 2003
	Sat. Receive only antenna	Information survey	Mgr/USPNet	Sep. 19, 2003
	TVRO Terminal	Information survey	Mgr/USPNet	Sep. 19, 2003
	Satellite Data Receiver	Information survey	Mgr/USPNet	Sep. 19, 2003
	Compatibility Study	Study	Mgr/USPNet	Nov. 21, 2003
	Report and Recomdat'n	Report	Mgr/USPNet	Dec. 19, 2003

6. Cost Implications

This Action Plan demands following costs for required equipment, and Earth Station building expansion.

(The cost of IP equipment varies significantly depending on Options with each device. The final cost should be found with further details of system design.)

- IP-readiness confirmation

(Suva, Lautoka and Vanuatu)

Item	Quantity	Unit Cost (FJ\$)	Cost (FJ\$)
Multimedia Access Router with Facsimile ports	1	50,000	50,000
	2	26,000	52,000
Media Convergence Server with Call Manager software	1	60,000	60,000
	1	32,000	32,000
IP Conference Phone	3	3,200	9,600
IP Phone	6	730	4,380
Total			207,980

(The upper Router and Server are for Suva. The lower Server is for Vanuatu.)

- Leased Line Video Bandwidth Utilization

(Labasa and Raiwaqa)

Item	Quantity	Unit Cost (FJ\$)	Cost (FJ\$)
Multimedia Access Router with Facsimile ports	2	26,000	52,000
IP Conference Phone	2	3,200	6,400
IP Phone	4	730	2,920
Total			61,320

- Leased line recurrent cost (Monthly)

(Telecom Fiji Leased Line Tariff between Suva and Lautoka/Labasa)

Data Rate	Access Charge (two ends)	Transmission Charge	Total cost of Leased line
64 kbps	FJ\$400	FJ\$1,610	FJ\$2,010
128 kbps	FJ\$420	FJ\$1,870	FJ\$2,290
512 kbps	FJ\$700	FJ\$3,400	FJ\$4,100

(Telecom Fiji Leased Line Tariff within Suva area)

Data Rate	Access Charge (two ends)	Transmission Charge	Total cost of Leased line
64 kbps	FJ\$400	FJ\$25	FJ\$425
256 kbps	FJ\$500	FJ\$30	FJ\$530

- Satellite Link Bandwidth Aggregation

(Samoa Mini-Hub and all Remote Earth Stations)

Item	Quantity	Unit Cost (FJ\$)	Cost (FJ\$)
Multimedia Access Router with Facsimile ports	10	26,000	260,000
Media Convergence Server with Call Manager software	1	32,000	32,000
IP Conference Phone	10	3,200	32,000
IP Phone	20	730	14,600
Total			338,600

- UPS installation to Hub Earth Station (Suva)

Item	Quantity	Unit Cost (FJ\$)	Cost (FJ\$)
Building expansion for installation space	80 m2	1,000	80,000
UPS with associated Power Control Board (30 kVA)	1 set	50,000	50,000
Power Distribution Board for UPS Power	1	15,000	15,000
Installation of Engine Generator	1 set	20,000	20,000
Total			165,000

- Expansion of Internet Connection Bandwidth

Provider	Data Rate	Monthly Cost	Annual Cost
Connect Ltd.	1 Mbps Symmetric	FJ\$50,000	FJ\$600,000
Southern Cross (3 year contract)	1 Mbps Symmetric	FJ\$45,851	FJ\$550,212
	6 Mbps Symmetric	FJ\$197,229	FJ\$2,366,748
Intelsat (Preliminary quotation)	1 Mbps/128 kbps Asymmetric	FJ\$11,000	FJ\$132,000

Note: Intelsat Service requires an initial non-recurrent cost of approximately FJ\$16,000. The Internet connection service in Fiji is currently provided by Connect Ltd. on Monopoly basis. Alternative connection to a service provider outside Fiji through the Southern Cross cable network or Intelsat satellite requires permission from the Telecommunications Authority.

7. Human Resources and Project Team

This Action Plan demands following human resources for implementing the solutions from various departments of the USP. The Project Team formation is recommended for efficient implementation of the Action Plan. The Project Leader would be DVC and Keith Moala would be suitable for the lead Project Officer considering his heavy involvement in USPNet Operation & Maintenance works and contribution to this Action Plan and the Medium to Long Term Plan for USPNet enhancement.

The Project Manager shall show strong leadership and coordinate the task relations from the project schedule point of view. This Project shall closely cooperate with the existing JICA ICT Project and seek the advice and opinion of JICA Experts for the implementation of this Action Plan.

- IP-readiness confirmation
- Leased Line Video Bandwidth Utilization
(Common for above two solutions)
 - ① System & Network Manager (4.5 months)
 - ② ITS Chief Engineer (2.8 months)
 - ③ IP Network Analyst (5.2 months)
 - ④ IP Network Technician (1.3 months)
 - ⑤ Video System Engineer (2.2 months)
 - ⑥ Video System Technician (3 weeks)
 - ⑦ University Extension Technician (2 weeks)
 - ⑧ USPNet Manager (1 month)
 - ⑨ USPNet Earth Station Technician (3 weeks)
 - ⑩ ICT Technician at each extension center (2 to 3 weeks)
- Satellite Bandwidth Aggregation
 - ① USPNet Manager (6.3 month)
 - ② USPNet Earth Station Technician (2.8 months)
 - ③ Chief Engineer, ITS (5 months)
 - ④ IP Network Analyst (2.1 months)
 - ⑤ IP Network Technician (1.5 months)
 - ⑥ Video System Engineer (1 month)
 - ⑦ ICT Technician at each extension center (2 to 3 weeks)

- UPS installation
 - ① USPNet Manager (3 months)
 - ② USPNet Earth Station Technician (2 months)
 - ③ Physical Planning Staff (2 months)

- Expansion of Internet Connection Bandwidth (Subject to the proceeding of Regulatory coordination with the Telecommunications Authority)
 - ① ITS Chief Engineer (4.8 months)
 - ② USPNet Manager (2.5 months)

- Satellite Receiver Survey
 - ① USPNet Manager (6.2 months)
 - ② USPNet Earth Station Technician (3 months)

8. Effect of Solution

The expected results of proposed solutions are as given below.

- IP-readiness confirmation
 - ① The completion of these confirmation tasks ensures the feasibility of implementing the IP-based USPNet on network-wide basis. If we are encountered with any troubles, we can accumulate the experience through solving them without damaging the daily operation of the University. This accumulation of experience forms the know-how for following wider implementation of IP-based USPNet and then its Operation and Maintenance.
 - ② No immediate beneficiaries are envisaged, as this is a preparation stage.

- Video Bandwidth Utilization
 - ① On successful confirmation of IP-based terminals functionality, we can start implementing IP-based WAN connection with Lautoka and Labasa. This brings the Bandwidth sharing among Video, Audio, Tel/Fax and Data. Consequently, the Data service will benefit much wider Bandwidth allocation when other services especially Video is not used. More specifically, the Data Bandwidth will be increased from current 40 kbps minimum/64 kbps maximum to 40 kbps minimum/192 kbps maximum, at the beginning. When the 512 kbps single leased line is introduced, the Data

Bandwidth will be further increased to 360 kbps minimum/512 kbps maximum. Raiwaqa will also enjoy the wider bandwidth of 256 kbps by shifting the cost saving resulted from Lautoka and Labasa line aggregation.

- ② Even on trial basis, the Staffs and Students at the trial site (three Extension Centres in Fiji) will enjoy the better PC network operation. The number of PCs at major Extension Centre is 40 to 50 and the number of beneficiaries can be estimated as three times as much as the number of PCs. Hence the total number of direct beneficiaries is estimated at least 450. Further to them, most of the students can be indirect beneficiaries of improved administration works, and the number of these indirect beneficiaries is estimated around 2,500 (10% less than the number of external students in Fiji).

- **Satellite Link Bandwidth Aggregation**

- ① For the satellite links, the immediate effect of introducing Multimedia Access Router is not so dramatic. 64 kbps shared Bandwidth is more dynamically allocated among Audio, Tel/Fax and Data, and Data service can enjoy 20 to 30% Bandwidth increase in average
- ② The aggregation of transmission channels from Hub Earth Station can improve the data flow in Hub to Mini-Hub/Remote direction as the previously under-used capacity for light user Remote stations can be used for heavy users. Mini-Hubs will also improve their transmission data rate and the data flow between three campuses will be much improved. Mini-Hubs will have the maximum of four time's larger data bandwidth while the minimum improvement remains about twice.
- ③ Video transmission from Hub and Mini-Hub stations will be released from satellite channel scheduling, as they are carried on a wider transmission channels from them. The satellite channel scheduling is only required when a videoconference is scheduled with a Remote station.
- ④ The direct beneficiaries are all data communications users at Mini-Hub and Remote Earth Station sites, and the number is estimated to be in the range of 1,000. (Again, three times the number of PCs.) The total beneficiaries shall include all extension students learning at these Extension Centres and the number will be around 1,500.

- UPS and Engine Generator installation to the Hub Earth Station
 - ① The installation of UPS and E/G will reduce the outage time of the Hub Earth Station from more than 1,100 minutes per year to the level of less than 50 minutes including inevitable outage due to Sun interference in Equinox season.
 - ② Consequently, the satellite network outage time will also be reduced, as the Hub Station outage has always caused total outage of the satellite network. The Hub Station controls all other Mini-Hub and Remote Earth Stations, and the Hub Station outage means total outage of the satellite network and when the power comes back, the network recovery usually takes half an hour in average due to the necessity of total satellite network re-configuration and synchronization process. Although the network restoration time is already included in the outage time calculation.
 - ③ From the service point of view, some Video lectures and conferences at ordinary lecture theatre or conference room without emergency power supply would still be affected by the commercial power failures. The situation is same for Facsimile machines. However, Video lectures/conferences, Audio tutorials and Data Services at Communications Building can be continued with the Engine Generator. Another Engine Generator supports PABX for Laucala campus and the telephone service will also continue its operation during the commercial power failure.
 - ④ The beneficiaries of this solution are all Staffs and Students using satellite network at all Earth Stations. The number of beneficiaries is estimated around 1, 500 considering the external students outside Fiji.
 - ⑤ The plan is to re-use the existing Engine Generator already bought by USP. It must also be noted that this imposes some limitations to the design of the UPS system for the Hub earth station.

- Expansion of Internet Connection Bandwidth
 - ① The expansion of Internet Connection Bandwidth can bring much faster and smoother access to the information resources on Internet. Direct beneficiaries are most of the academic staffs and students. The better access to the wider information resources in the shorter time will result in the higher research/study efficiency, and hence better academic achievement.

- ② Other beneficiaries are the people visiting the USP Web site. They can enjoy better response while they browse the web site. Accordingly, the USP will be better acknowledged by the people outside the University and have more opportunities to collaborate widely with the people and/or organization outside.

- Satellite Receiver Survey
 - ① This survey is to study the feasibility of satellite receive only terminals in the USPNet. There are no immediate beneficiaries from this activity, but if it is found to be feasible, potential beneficiaries in the future can be in the order of thousands.

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