TELECOMMUNICATIONS DEVELOPMENT IN THE SMALLER SOUTH PACIFIC NATIONS

presented by

REG MOTION

Introduction

We are fortunate indeed to have a speaker tonight of the calibre of Reg. His association with Electronics began in 1936, when he became a radio serviceman in private industry. Shortly after he joined the NZ Post office, working on switching equipment until the advent of World War 11, when the Post Office transferred him firstly to life construction of Radar equipment for the Services, then to maintenance and construction duties. During this time he saw service in Fiji before returning to NZ as a radio Instructor at the Post Office Training School.

In 1944, as a Senior Technician (Radio), he designed and developed many Items of radio equipment for the Post Office, including equipment for a quartz crystal processing laboratory, an advanced VHF land mobile transmitter, and an advanced digital frequency measuring system for the Makers measurement service. He was also involved in the installation of several VHF multichannel links and the testing of the New Plymouth - Palmerston North microwave system.

Qualifying as a Professional Engineer in 1964, he was appointed as Senior Engineer (Radio) with the Post office. As such he was involved with the planning of microwave links in both the North and South Islands, until in 1966 as Supervising Engineer he was responsible for advising on, specifying and acceptance of P.O. equipment - including that required for life Warkworth Satellite Earth Station and the microwave bearers for the toll system expansion within New Zealand. In 1968 he was appointed a member of the N.Z. delegation to a CCIR meeting in Geneva, followed by a period of extended leave in Europe.

On his return he controlled the assignment of all allocated radio frequencies within N.Z. and its dependencies. During this time he developed like specifications for the 12.5 kHz bandwidth land mobile systems, expanding and updating the approval system for new equipment. On his promotion to Divisional Engineer (Radio), he had oversight of the N.Z. wide land mobile services, the purchasing, development and technical operation of all radio equipment required by the P.O., Including all HF and microwave equipment. He was also technical adviser to the N.Z. Fire Service. In 1976 he became Superintending Engineer responsible for all radio services operated by the P.O., Including HF, VHF, microwave, satellite and the domestic FM service.

After his '*retirement" lie became a Consulting Engineer, advising Pubic bodies such as the Park Board and Civil Defense on communications matters. Later he was requested by the Tokelau administration to advise them on the improvement of their external and internal communications

systems. Following this he managed a South Pacific Telecommications Development Project for the Technical Cooperation Department of the International Telecommunication Union. This project is operating throughout 14 Countries, Included VHF, microwave and satellite systems.

I consider it an honour to be given the opportunity of delivering the Ralph Slade Memorial Lecture for this year. Ralph joined the New Zealand Post Office on the technical side in Dundedin as I did, he was slightly ahead of me, and we were both involved in the development of electronic equipment and services within NZ. His few years seniority probably accounted for the fact that we never personally met. Notwithstanding this I was always well aware of the tremendous contribution Ralph was making to telecommunications and to the electronics industry through his radio amateur successes, his war effort and his inspiration that became EDAC.

Your President informed me that the subject matter of this address may vary widely. Past lectures have been centered on New Zealand. I feel sure that Ralph would not mind if I take us off shore this year and discuss telecommunications development in the smaller nations of the South Pacific. Especially as it is development and I find that there is a general lack of knowledge of the subject in New Zealand even though these islanders are our near neighbours.

CHARACTER AND HISTORY

The smaller South Pacific island communities are among the most self-sufficient in the world. It has been said that if the world was to suffer an atomic holocaust they would be the most likely communities to survive. Their food though simple grows naturally on their islands, the sea contains the fish they need and they have developed social systems suitable for their continuing existence. The climate is mild and clothing is not a problem. In historical measure they have been relatively contented until recent times. Apart from the need to repel the odd raid and occasional hurricanes there has been little to cause them trouble.

With the advent of the early discoverers, missionaries and trading ships these island communities began to learn of a different existence - a more complex, more material existence. In some ways a more exciting life.

This learning process continued through the period of colonisation until today they are well aware of the world outside. Many of their elders have misgivings about the changes taking place but most recognise that they cannot reverse the flow: for better or worse they have become part of the larger world. Accepting this fact, they are concerned to see that changes are made in the most efficient manner without losing the good points of their existing cultures.

Trading with the outside world requires that they organise in large groupings of individual islands thus producing problems of inter-island as well as external communications. Information transfer is now as important to the South Pacific islander as it is to any person in the developed world.

The area of the earths surface in which these small nations are developing is vast. In the East it starts at longitude 130E and it extends to longitude 150W. Its Southern limit is latitude 25S and its Northern boundary 15N. At the equator its width is 8500km and its depth 4300km. Excluding Papua New Guinea, since it can hardly be described as small, Viti Levu (roughly 130km in diameter) is the largest island of any of the developing nations in this area with most being much smaller. The picture is one of a vast area of sea with tiny dots of land widely spaced within it.

All Pacific Islands are the tops of submerged mountain ranges. Some rise well above the surface of the sea as, for example, New Zealand, Fiji and Western Samoa. Others barely / rarely reach sea level or are slightly submerged. The major difference between New Zealand and the tropical islands' is the presence of a reef of coral surrounding the latter. This coral reef shelters the larger islands against sea forces and forms the coral atolls on top of submerged mountain peaks.

In telecommunication the presence of coral is and environmental feature which must be given due consideration.

Table I lists the smaller developing nations in the South Pacific and gives some approximate numbers to assist in forming an impression of the communication task within each nation. The maximum linking distance shown is the distance between extremes of population while the number of populated islands sets the number of overseas paths required to link the nation together. Niue, Nauru and Western Samoa have the least difficulty while Kiribati with the vast distances between its three groups of islands has the greatest problem.

Of course distance does not tell the whole story. Ability of the populace to pay for the service varies widely. Countries like Nauru, and Fiji with their relatively large export trades are reasonably well placed while the coral atoll nations including Kiribati, Marshall Islands, Tuvalu and Tokelau are at a severe disadvantage; copra and fishing rights together possibly with tourism are their sole sources of overseas funds.

TABLE 1

Nation	Population	Land Area Sq.kms	Number of islands	Max. link distance(kms)
Fiji (1970)	700,000	18,376	320	600
Solomon Islands (1978)	280,000	29,800	40+	1,000
Western Samoa (1962)	150,000	2,900	4	150
Vanuatu (1980)	150,000	13,000	80	800
Tonga	100,000	700	40	300
Federated States of Micronesia (1989)	80,000	600	36	3,000
Kiribati (1979)	60,000	820	25	3,500
Marshall Islands (1989)	35,000	171	34	1,000
Cook Islands (1965)	15,000	230	13	2,000
Palau (*)	14,000	460	8	160
Tuvalu (1978)	10,000	26	9	560
Nauru	9,000	24	1	5
Niue (1974)	3,000	260	1	15
Tokelau (*)	1,500	12	4	500

( ) date of achieving independance

(*) not yet fully self-governing.

APPROPRIATE TECHNOLOGY

A great deal has been said about choice of appropriate technology for use in developing countries. Unfortunately when it comes to telecommunications there is not a great deal of choice as the equipment available has largely been designed for use in developed countries and it is a case of take it or leave it. Nor is it often practicable to install tried and proven designs as the speed of design change makes it certain that any attempt to do so will load the country with systems which are out of date producing all sorts of problems with spares provision, expansion, staff training and inter-working.

With these limitations in mind the following comments are offered on the suitability of available equipments.

Solid-state switching systems from reputable manufacturers have now achieved a high degree of reliability where they are installed in air-conditioned enclosures, as is usually the case for major switching centres. The extent of self-checking incorporated is important as it may reduce the training required for the operating staff.

Outside major switching centres the environment is more hostile. Air conditioning is seldom practicable, local power supplies can be erratic and maintenance arrangements elementary. High reliability is essential and low power demand can allow the use of the more reliable solar powering. In recent times switching equipment has been produced to meet these conditions in the more remote parts of developed countries and initial trials are encouraging.

Underground cabling for subscriber reticulation is preferable to overhead lines or cables which have short lives in the hot sun and tropical storms. Such cable should be jelly filled; pressurised cables are not recommended, as satisfactory maintenance of the compressor cannot always be guaranteed. Near high metallic structures such as radio masts, cables may need protection against lightning damage. In some countries leave to bury cables may be difficult to obtain.

UHF radio systems (e.g. cellular or point to multipoint) have been proposed for individual 41 subscriber reticulation but a major problem here is charging the batteries at the subscribers terminal. Local power if available is often ' unreliable and solar power is expensive. Radio may be justified where the phone serves a small community.

Methods for linking local area networks within an island include all the practices of developed countries; wire line, copper cable, optical fibre and line of sight radio. However, in determining the optimum system, powering and maintenance should be major considerations if high reliability is to be achieved.

When the path traverses water and line of sight cannot be obtained the choices are severely restricted and unfortunately this is very often the case in Pacific Island nations.

For links which are just outside line of sight, VHF or UHF radio may be practicable depending on the time variations in refractive index over the path. Measurements taken from operational links in Vanuatu suggest that these variations are not as great as might otherwise be predicted for tropical climates.

Well outside line of sight there are only three possibilities, HF radio, troposcatter and satellite.

High frequency (HF) radio is subject to all the vagaries of the ionosphere but the paths are never more than single hop and where cost allows no

other choice, marginally satisfactory circuits may be obtained for one or two channels, especially if operating hours are restricted to daytime.

Frequency diversity and Lincompex may be used at added cost to improve the reliability of HF circuits. In recent times frequency agile systems have become available. These automatically and continuously monitor a number of radio frequencies then assign the best of these frequencies when a path is required. One such system has been installed for communication within Tokelau.

Tropospheric scatter systems require relatively high UHF power, high gain antennas and sophisticated receivers. The heavy mains power drain of a terminal usually necessitates continuously running diesel alternators with attendant high fuel and maintenance costs. Al1 this adds up to a considerable capital investment for a system which often does not deliver the design performance.

From a performance point of view linking via a geostationary satellite has everything to commend it. Unfortunately the high capital and running costs have, until recently, ruled out this system for all but high-density traffic links and there are few of these in the national systems within the South Pacific.

A few years ago INTELSAT acknowledged this fact and introduced the D1 specification. This allowed antennas as small as 5m diameter which considerably reduced the capital costs of the earth station but even this did not produce a flood of domestic linking systems. High satellite access costs still applied.

In recent years a system which allows earth stations to access channels as required has been developed. This system known as Demand Assigned Multiple Access (DAMA) has a control station which monitors a group of satellite channels. When an earth station requires a channel it signals control via one particular channel telling control its location and the location of the earth station with which it desires connection. Control then selects an idle satellite channel and tells the calling and called earth stations to meet on that channel. Normal calling procedures are then used by both earth stations to connect the subscribers. Following completion of the call Control notes the release and reassigns the released satellite channels elsewhere as required. This system makes better use of satellite channels as well as reducing the access costs for the earth station - the earth station operator is only charged for the period of use of a satellite channel.

STATE OF THE NETWORKS

Regrettably most of the colonising nations paid scant heed to the communication needs of their colonies during the colonial periods. When they achieved independence most of the small nations we are considering had in their major centres of population local switching systems composed of equipment retired from the colonising country together with an HF link back to that country. A few had HF telegraph links to their outer islands otherwise communication relied on surface transport.

Considering that they started with almost nothing. It is a credit to these small nations that they have established the networks now in existence in the short time since their independence. Certainly there has been outside help but the dogged determination with which they have pursued their aims has been the major factor in their achievements. A brief overview of the position is as follows.

FIJI has a well developed network covering its major centres of population using microwave linking and crossbar automatic switching. Conversion to solid state is under way. Outside of the main centres a good deal of work is required to complete coverage of the whole population. Control of National communications is under a Government Department and International of a Joint Government/Cable and Wireless Company (FINTEL). Fiji has both cable and satellite linking with the rest of the world.

SOLOMON ISLANDS has modern solid-state switching systems covering its larger centres of population with a domestic satellite system linking some of these centres. National and International communications are being handled by a joint government/Cable and Wireless company.

WESTERN SAMOA government operates both international and national telecommunications. The national system has a fully loaded crossbar switch at Apia and some rural switches (mostly manual) in districts linked to Apia by VHF. Action is in hand to extend the Apia switch with solid-state equipment and to update other parts of the system. A standard B satellite station provides international service via INTELSAT. This station is being renewed and relocated.

VANUATU has a fully loaded reed relay switch at its capital Port Vila and a small electromechanical switch at Luganville linked to Port Vila via a stretched HF multichannel bearer. National and International communications are provided by VANITEL a joint Cable and Wireless/Societe Franc Cables et Radio/Vanuatu Government company.

TONGA has recently completely modernised its network with solid-state switches at its major centres linked via a tropospheric scatter system. A government corporation runs the national network with a Cable and Wireless company providing international communication via a standard B earth station. Some of the smaller and more distant islands are linked with HF radio.

FEDERATED STATES OF MICRONESIA (FSM) has a standard B earth station complex linking its four states (Yap, Truk, Kosrae & Ponape) and giving international service via INTELSAT. The four state capitals have automatic switching systems. A company has been formed to run the network and plans are in hand for an extensive upgrade.

MARSHALL ISLANDS has established a National Telecommunications Authority and is actively proceeding with establishment of a comprehensive national communications system to replace the existing inadequate service.

They have a standard B earth station providing domestic service to the island of Ebeye and international service - both via INTELSAT.

KIRIBATI has a modern solid state switching system covering Tarawa with a standard B earth station for international traffic. Both are operated by the government with some outside managerial assistance. A skeleton HF radio service covers some of the outer islands. Distant Kiribati Island is being provided with a satellite earth station to connect it with Tarawa.

COOK ISLANDS has a modern solid-state telecommunications switch serving Rarotonga with a standard B earth station for international traffic. Services to other islands of the group used HF radio but action is well advanced with the provision of standard D1 earth stations and solid-state switches for the islands of Aitutaki and Atiu. The national system is run by Government and the international by Cable and Wireless Ltd.

PALAU has recently extended its step by step switch and its overhead cabling system in Koror as a temporary measure to meet demand while the Palau National Communications Corporation (PNCC) considered its plans for a comprehensive national service. International services is obtained via a standard B earth station.

TUVALU international communication has recently been modernised with a standard D1 earth station replacing its HF link to Fiji. Funafuti has a small solid-state switch and is reticulated by underground cable. Other islands are connected to Funafuti by HF radio. All communications are controlled and operated by a department of government.

NAURU telecommunications system has a crossbar switch with underground cable reticulation covering most of the island population. A standard B earth station provides international communication. National and International are owned and operated by the Nauru government.

NIUE has recently replaced its HF international system with a standard D1 earth station. Cable reticulation has been upgraded to give coverage of most of the population and the manual switch has been replaced with a modern solid-state type. Niue Government owns and operates all its telecommunications.

TOKELAU consists of three tiny atolls and an administrative office at Western Samoa. The atolls each have solid-state switches with underground plus underwater cabling reticulation. Communication between atolls is via automatic dialling over a frequency agile HF radio system. The latter is proving difficult to maintain and is of inadequate size for the traffic. Preliminary consideration is being given to replacement with a D1 earth station complex but capital and running costs are inhibiting this move.

ENVIRONMENTAL CONSIDERATIONS

All islands are in the hurricane belt and structure design to meet hurricane force winds is a necessity. Very few atolls have dry land more than 5m above sea level

and in hurricane conditions it is not uncommon for seawater, driven by the wind, to sweep across the land causing considerable devastation.

High temperature and humidity often cause problems where air conditioning is not practicable. Otherwise on the larger volcanic islands conditions are little different from those in the far North of New Zealand. Near the coasts salt laden air is prevalent as in NZ and protection of metals against corrosion is essential. Abrasive coral dust may also be present and affect mechanical devices as well as electrical contacts. On the coral atolls environmental conditions are extreme. Wind blown salt laden air mixed with coral dust is almost always present. The corrosion rate of metals is high and without protection the dust causes problems with mechanical moving parts including plug in connectors. Electronic components must be adequately tropic proofed by coating or otherwise. Ferroconcrete structures are often built with coral aggregate which is porous and where water is present, as in foundations, precautions such as galvanising must be taken to prevent erosion of the reinforcing steel. A number of protection methods are available; expert advice is required. Island power systems where they exist should be regarded with caution. The standard of installation and maintenance of these systems is often low; long outages and extreme power surges are Common. Properly designed solar power systems are preferable though costly.

Obtaining access for installation or maintenance is a major problem outside of those towns and cities served by International airlines. Some of the smaller islands have airstrips but a very large number are served only by small ships. Shipping visits are infrequent and many of the islands do not have port facilities. At these off loading from the ship is limited to items which can be taken in through the reef on small boats.

TECHNICAL ASSISTANCE

Individual Nations, in particular Australia, New Zealand and the United Kingdom have helped countries of the South Pacific with technical advice, operational assistance and sometimes donations of equipment. This help has been largely on a bilateral basis.

Probably the most effective source of technical assistance for developing countries in the Pacific has been the International Telecommunication Union (ITU). The history, structure and aims of this body are not well known outside of the telecommunications industry thus it is worthwhile briefly covering them at this point.

The ITU had its origin in the 1860's when national telegraph systems which had their own telegraph codes and charges required International linking. Ad hoc coding and charging agreements soon became cumbersome and the need for an International agreement became obvious. An International Telegraph Convention was drawn up in Paris in 1865 and this later was extended to an International Telecommunication Convention. 20 Countries participated in the original convention, today 166 countries are members of the Union and meet periodically to draw up by mutual agreement, a Convention, regulations governing the conduct of telecommunications

services and recommendations concerning the standardization of equipment and operation of telecommunications services.

The major work of the ITU is carried out at conferences with assistance from the permanent organs of the Union, the General Secretariat, the International Frequency Registration Board (IFRB), the International Radio Consultative Committee (CCIR) and the International Telephone and Telegraph Consultative Committee (CCITT).

Briefly the purposes of the Union are: *
To maintain and extend international cooperation between all Members of the Union for the improvement and rational use of telecommunication of all kinds

* To promote and offer technical assistance to developing countries in the field of Telecommunication and

* To promote the development of technical facilities and their most efficient operation with a view to improving the efficiency of telecommunication services, increasing their usefulness and making them as far as possible, generally available to the public.

In 1949 the ITU became a specialized agency of United Nations with responsibility for telecommunications and since then has continued to expand its activities in the field of technical assistance to developing countries. A Technical Cooperation Department (TCD) was formed in 1960 to integrate the activities up to that time and this has recently been incorporated in a new permanent Telecommunication Development Bureau (TDB).

Finance for the activities of the TCD was largely from the United Nations Development Fund but with the formation of the BDT funds will be made available from the Union to increase the range and effectiveness of the assistance being given.

Basically, the aims of technical cooperation are:

* Improvement of telecommunications equipment and services in the developing countries by means of the dissemination of information and advice *
The transfer of know-how, *
Institution building and
* The enhancement of self-reliance among the less advanced countries.
The ITU obtains experienced personnel for deployment in developing countries by direct employment or by the seconding for limited periods of working personnel from the Telecommunication Organisations of Members of the Union. Developed countries of the Union have participated very well in this regard to the benefit of the countries being assisted.

Advice and assistance is also available as required from the ITU's permanent organs, the CCIR, CCITT and IFRB. Thus ITU can deploy

independent expertise in specialist fields with language and cultural qualities to suit the country being assisted.

Assistance is only given at the request of countries and in the South Pacific. This request first arose from discussion by Governments at the initial meeting of the South Pacific Forum in 1971.

This first Forum meeting highlighted the inadequacies of telecommunication in the area, the upshot of which was a request to United Nations to identify the scope of assistance required to develop satisfactory telecommunication. ITU prepared a series of projects for this purpose and work, funded by UNDP, commenced in 1971.

During the course of the first ITU Project (investigatory stage) the countries of the South Pacific Forum established the South Pacific Bureau for Economic Cooperation (SPEC) and gave that organisation responsibility for coordinating the development of efficient and reliable regional telecommunications for the island countries of the South Pacific. For that purpose SPEC established an annual meeting of representatives from national telecommunication organisations in the region (SPECTEL) at which regional telecommunications plans are reviewed and strategies coordinated.

Once the ITU had defined the communications required and as far as possible quantified the benefits to be obtained, efforts were concentrated on the needed developments. As might be expected, International communication links with their high return on invested capital were quite rapidly instituted. In the larger countries earth stations were established, either by licensing private companies, or by forming joint ventures with such companies or by governments directly with the help of aid funding. ITU assistance was sought and given in the latter cases for the preparation of specifications, consideration of tenders and oversight of installations. In the smaller countries International HF services were greatly improved with the help of expertise principally provided by ITU.

National services were more difficult to establish although most nations managed to obtain automatic switching systems within their capitals by the early 80's. ITU gave technical assistance where requested.

National services to points outside of the main centres (rural services) were and still are slow to develop, mainly because the capital needs for these services are considerable and the direct returns poor. Although there are social, political and indirect economic benefits to be obtained from rural services these are difficult to quantify. Thus convincing planners, and funding agencies of the need for investment of scarce capital is a hurdle that is hard to overcome, even to this day.

Realising this need for rural telecommunication development the South Pacific Forum called in the early 1980's for a report on the means and the costs of provision. Australian and New Zealand engineers, assisted by the ITU where required, prepared this report, which outlined the

means which might be employed and established that a sum upwards of US$100M would be required for implementation.

Raising this sum was acknowledged to be a Herculean task. Australia and New Zealand agreed to finance a Telecommunications Controller and staff within SPEC to investigate funding methods, seek funds, enable bulk purchasing and generally cooperate with countries in their development actions. Thus the South Pacific Telecommunication Development Programme (SPTOP) was formed.

It soon became evident that funding agencies desired a great deal of detail, especially as to the full telecommunications development plans of the countries concerned and at the request of individual countries ITU, with funding from UNDP, provided Master Telecommunication Development Plans. Each of these was a major effort involving the formation of a team of specialist engineers, accountants, and administration experts who explored the various telecommunications development possibilities in detail then made wide ranging recommendations for a 5 - 10 year plan with full costing, anticipated revenues and social benefits.

These Master Plans were well received by the countries and are being widely used to obtain funding with some success.

Some countries elected to enter joint ventures with overseas telecommunications organisations. There is no doubt in my mind that this is a very good way of satisfying a country's telecommunication needs but it does require that the joint venture agreement be carefully constructed to ensure satisfaction for both the country and the organisation. ITU is well placed to provide independent expertise in this regard and has carried out a number of missions advising countries on joint ventures in the South Pacific.

Apart from the above ITU has carried out a wide variety of other activities at the request of individual countries in the South Pacific. These have included development of accounting methods, computerisation of accounting, forecasting, cable planning and installation, broadcast planning, domestic satellite planning and management systems development.

To date the SPTDP has obtained some bilateral funding, produced equipment specifications for general use by countries and has been instrumental in arranging a DAMA system of satellite operation within the Pacific thus greatly reducing the satellite costs for domestic satellite services within the countries of the region.

FUNDING

Telecommunications development is capital intensive - worse still it is primarily overseas funds which need to be spent and in developing countries funds are in chronic short supply.

Commercial loans of the usual types**.** Most telecommunications purchases are made with borrowed capital or with aid funds. These are obtained in many ways the principal sources being as follows.

Bilateral aid which in the South Pacific is principally given by New Zealand, Australia, United Kingdom, Japan, France, Canada and USA. As might be expected this type of aid 1s usually directed towards former colonies or dependencies and expenditure is sometimes tied to the country of aid origin.

Multilateral aid is given by the European Economic Community (EEC), the Asian Development Bank (ADB) and World Bank. EEC aid is restricted to those countries which qualify under the Lome Agreement (principally former colonies of European Nations) and purchasing preference 1s given to EEC countries. ADB does not seem to have any restriction on the countries to which it gives aid while World Bank seems to have a lower limit of aid making Fiji the only nation likely to comply in the nations we are concerned with.

Aid may be in the form of direct grants or soft loans (low interest, long repayment periods).

MAINTENANCE

Apart from the transport problems provision and installation of telecommunications equipment in the South Pacific is not greatly different from that in developed countries. However maintenance of the installed equipment is an entirely different matter. Staffing and provision of spares provide major headaches for administrators. Few countries can afford to directly employ expatriate staff for maintenance. Their salaries and benefits, although usually modest by the standards of developed countries, are well above local rates and this not only strains the exchequer but also can be the cause of local discontent. Some expatriates have been and are employed in key positions with assistance from outside funding agencies. Otherwise local staff must carry out maintenance duties. This poses the question of training.

The first approaches to training were to send local personnel for training in developed countries. This was only partially successful as the basic education in South Pacific countries is not technically oriented thus students started at a considerable disadvantage. Added to this those students who did make the grade realised that they could obtain much higher salaries by working in developed countries and many were lost for this reason.

With the assistance of UNDP and ITU a training centre was established in Fiji and this caters for the region apart from the Solomon Islands where a school, established with British assistance, provides training for local staff. Some efforts have been made to localise training in other countries especially in providing training as a preliminary to the school in Fiji and these have been partially successful.

While the standard of local staff varies widely between countries my own assessment is that overall it is only moderate. This is not the fault of the instructors but is caused by a lack of appreciation by the communities at large of the work carried out by their technical staff which results in a relatively low status for this work. Time may mend this situation.

The second problem, provision of spares, causes difficulties in most countries. In many countries transport and payment problems are such that spares cannot be quickly obtained from overseas suppliers and the maintenance of an adequate pool of spares to cover all contingencies is seldom practicable within the national budgeting restraints.

Thus quite long equipment outages are common and I believe are likely to remain so until equipment developers came up with systems which have extremely low failure rates and are self-diagnostic when they fail. It is heartening to see that modern solid state systems are moving in this direction even though there is still a long way to go.

The lesson to be learnt is that, in the harsh environment of the South Pacific, system engineers and suppliers must give primary consideration to failure rates and maintainability of hardware and software. This applies not only to internal equipment but also to power supplies, outside plant items and peripheral plant. It especially applies to mechanical and electromechanical devices e.g. rotating machines, printers, air compressors, relays etc.

CONCLUSION

I hope that this discourse has contributed to your knowledge of the telecommunications development going on in the smaller South Pacific nations. I will be particularly happy if it results in practical assistance to these nations from New Zealanders in one way or another, as I know that New Zealanders as a whole easily identify with the South Pacific Nationals and are readily accepted by them.

FURTHER READING

This talk has of necessity dealt but briefly with most of the issues. Further information is available in book and report form of which the following is a selection as a starting point.

"Pacific Islands Yearbook" published by Pacific Islands Publications (Aust) Pty Ltd is an excellent source of general information on island matters.

"South Pacific Telecommunication Development Programme - Planning Report" (SPEC (86) published by the South Pacific Bureau for Economic Cooperation, Suva, Fiji covers the practical points involved in rural telecommunication development.

"Transport and Communications for Pacific Microstates" edited by C C Kissling and published by the Institute of Pacific Studies of the University of

the South Pacific deals with the sea and air transport problem as well as telecommunication.

"The Missing Link", a report published by the ITU in Geneva discusses the urgent need to close the wide gap between telecommunication availability in developed and developing countries and makes some recommendations accordingly.