INVESTIGATION INTO THE USE OF SPATIAL INFORMATION AND GEOGRAPHIC INFORMATION SYSTEM/REMOTE SENSING TECHNIQUES IN THE SOUTH PACIFIC

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P. Colotte
EC Consultant
Authevernes 27420, FRANCE

and
J. de Meijere
ITC
7500 AA Enschede, The Netherlands

with the participation of
D. Claasen
Great Barrier Reef Marine Park Authority
Townsville, Australia

Edited by the
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LIST OF ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
AKCLIS	Australian Key Centre for Land Information Studies
AIDAB	Australian International Development Assistance Bureau
AUSLIG	Australian Land Information Group
CRGA	Committee of Representatives of Governments and Administrations (SPC)
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
CZM	Coastal Zone Management
DSIR	Department of Scientific and Industrial Research (New Zealand)
EC	European Community
ESCAP	Economic and Social Commission for Asia and the Pacific (UNESCO)
EVAAM	Etablissement pour la valorisation des activities aquacoles et maritimes (French Polynesia)
FAO	Food and Agriculture Organization of the United Nations
FFA	Forum Fisheries Agency
FS	Forum Secretariat
GIS	Geographic information system
GRID	Global Resource Information Database (UNEP)
IFREMER	Institut français de recherche pour l'exploitation de la mer
IFRP	Inshore Fisheries Research Project (SPC)
IMR	Institute of Marine Resources (USP)
LATICAL	Laboratoire pour la traitement et l'analyse des images Caledonien
LIS	Land information system
ORSTOM	Institut français de recherche scientifique pour le développement en coopération
PIMRIS	Pacific Islands Marine Resources Information System
PIN	Pacific Island Nation
RS	Remote sensing
RTFD	Regional Tuna Fisheries Database
SMA	Service de la mer et de l'aquaculture (French Polynesia)
SOPAC	South Pacific Applied Geoscience Commission
SPC	South Pacific Commission
SPOCC	South Pacific Organisations Co-ordinating Committee
SPREP	South Pacific Regional Environment Programme
SPT	Station Polynésienne de Telédetection (French Polynesia)
TBAP	Tuna and Billfish Assessment Programme (SPC)
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Social and Cultural Organisation
UNEP	United Nations Environment Programme
UNITECH	Papua New Guinea University of Technology
USAID	United States Agency for International Development
UFPS	Université Francaise du Pacifique Sud
USP	University of the South Pacific

SUMMARY

A mission was commissioned to investigate the availability of spatial information and ways of improving the use of this information within SPC and Pacific Island countries. Spatial information includes all data on terrestrial and marine natural resources that bear reference to their location. These data are generally represented on maps and are required for development and planning of resources.

The mission focussed on the way spatial data are collected and processed. Modern techniques such as aerial photo interpretation, satellite image processing and geographic information systems (GIS) are increasingly being used in the South Pacific region. A number of institutes in Australia, New Zealand and the French Territories are advanced in the use of remote sensing (RS) and GIS. Some island countries have already been using some of the above techniques and technologies for some time, while others are introducing them.

Their introduction and use can lead to problems of a technical, economic or management nature. The major problems are: difficult access to data; lack of technical services; great mobility and lack of skilled personnel; poor access to funds for support; lack of standards for data exchange; and a lack of awareness of the benefits of modern techniques among managerial level staff. These problems should be addressed at a regional scale.

The mission proposes a programme (SPIDER), housed by SPC, working through a network of contacts with institutions handling spatial data. The focal point of the network should be established at SPC to match identified problems with solutions provided by specialised institutions.

The proposed programme includes the following activities:

- re-activate and expand the network of existing institutes handling spatial data;
- establish a meta-database in which information on data, equipment, services, programmes and donors is available;
- provide support to encourage the increased use of remote sensing (RS) techniques for resource surveys and monitoring;
- provide "trouble shooting" and information system development support to user organisations, and follow-up support to implemented systems;
- establish a regional committee for standards and perform its secretarial functions;
- provide support for training and fellowships/scholarships.

The SPIDER programme should be realised through a project with an initial lifetime of 5 years. It must cooperate closely with the SPREP/GRID project and should approach ESCAP with a proposal to make SPIDER the South Pacific node in the ESCAP/RSP. The SPIDER project should also be used by donor agencies and regional organisations to reduce the risks of duplication of work in this technical area by national and regional bodies in the South Pacific.

Within SPC, capabilities in digital spatial data handling in general are limited and need to be improved. There are a number of programmes that need to use RS and GIS techniques to improve project planning and implementation. Some programmes wish to increase their analytical and mapping capabilities, for which GIS technology can be used.

As a part of the SPIDER programme, or by elaborating a separate project, SPC should install a PC based image processing RS system and two GIS systems at the head office for general use by the programmes.

Some donor agencies are becoming concerned about the risk of duplications and uncoordinated actions in the transfer of modern spatial data technology. In order to address these potential problems, a meeting is being planned in March 1991 by AIDAB and ESCAP. The presentation of the SPIDER programme by SPC at that meeting could be a major contribution for the successful transfer of this technology in the future. This will ultimately result in better information for development planning and natural resource management in the South Pacific Region.

1 INTRODUCTION

1.1 Terms of Reference

The terms of reference for the present report stated that the mission should investigate:

> *"means of improving the availability of geographic information to, and its utilisation by, the SPC work programme, and, beyond that, the regional users whose activities the Commission supports".*

Annex 3 provides the full terms of reference.

1.2 Glossary

In the present context...

Geo-Information means all data on objects and areas of land or sea for which geo-referencing is provided or requested. These data are called spatial data, and are generally presented on a map. Geo-information can encompass all data to be found in maps, atlases, resource inventories, air-photos and satellite images.

Geographic Information System (GIS), or land information system (LIS), means a structured set of digital geo-referenced data of relevance to, and operated within, an organisation. The data can be used for tasks such as area registration, planning, and making decisions on the execution of plans.

GI Software means the software used to manage geo-referenced data. In this report we will refer as much as possible to the software as GI software.

1.3 Spatial Data Collection and Handling in the South Pacific Region

Geo-information is required and handled by all organisations involved in natural resource administration, natural resource use and protection, whether on land or sea.

Spatial data in the South Pacific relate to marine and terrestrial environments. The management of natural resources is a critical issue in the region, since the dependence on natural resources for survival and development is very high. The economic development which is already taking place puts stress on these natural resources. Loss of land or land quality can mean a direct threat for food production. Siltation and pollution of nearshore areas cause loss of fishing potential. Over-exploitation of deep sea areas endangers sustainable economic development. Tourism, mineral exploitation and marine resource exploitation affect the environment. Natural disasters such as cyclones occur frequently and require quick action from governments.

Careful planning and monitoring is therefore required. As most countries have limited human resources, a number of specialised regional organisations, such as SPC, SPREP, SOPAC, FS and FFA assist the South Pacific countries in their actions. Each of them uses or produces spatial information at various scales.

The South Pacific area, as an administrative unit, is one of the largest in the world. At the same time it is spread over a large number of individual units. It also has one of the smallest land areas and a low average population density (although in some islands, such as Tarawa, population density is among the highest in the world).

All these characteristics mean that spatial information must be handled at very different scales, ranging from small-scale (1:10,000,000) for environmental, climate and ocean resource mapping, to large-scale (1:5,000) for urban and coastal mapping. Also at the regional level some very small scale mapping is performed, such as Exclusive Economic Zone mapping.

Given the limited human and financial resources, the collection of geo-data at all these scales is a tremendous task. Nonetheless many regional organisations, countries and territories have made considerable progress in the acquisition and storage of spatial information.

1.4 Techniques For Spatial Data Collection And Processing

Traditional survey techniques are often too costly and time consuming for the required supply of data. In addition, the lack of manpower in most countries mandates the use of modern procedures. Aerial photographs and satellite images have proven to be useful for faster collection and better area coverage, leading to cheaper information. The use of digital techniques has considerably improved the efficiency of photogrammetric and cartographic procedures. The availability of digital data storage facilities contributes to faster (map) update procedures and reduction in physical storage space (offices, file cabinets), as well as providing possibilities for handling large amounts of finely detailed information.

Presently many organisations who are primarily users of spatial information, are investigating and discovering how data processing and information generation can be facilitated and improved by digital techniques. Geo-Information software and Geo-Information Systems, when properly installed and operated, can contribute to better performance in terms of speed, quality and cost. It is thus understandable that regional and national institutions are attracted by modern techniques to support their tasks. A majority of South Pacific countries are already using, or planning to use, modern techniques for spatial data collection, storage, and processing (RS techniques, computer assisted cartography and GIS techniques). In many countries the awareness is growing that digital storage techniques will allow for linkages of data sets for the production of information.

1.5 The use of GIS and RS in Pacific Island countries

Some countries of the South Pacific Region (Cook Islands, Fiji, PNG, Solomon Islands, Western Samoa and the French Territories) have been using the analogue interpretation of maps and air-photos for quite a time. However, the others are not yet at that stage. A great number do not have the research institutions to support GIS technology. The countries therefore depend on external support for the introduction of digital GIS technology.

Many countries are already using digital techniques to various degrees, or are about to. A non-exhaustive list of countries and institutions where digital (geo)-data processing is already taking place is as follows:

Cook Islands - Ministry of Lands (since 1973)
Project: Soil survey with DSIR
Hard/software: AT-286, DBase III, AUTOCAD, PC-ARC/INFO
Objective: Land use capability mapping
Problems stated: Insufficient operating staff, lack of funds for maintenance of software. System has to be used also for cadastral mapping.

Fiji - Ministry of Lands (since 1990)
Project: Fiji land Information System, with DOSLI
Hard/software: To be defined, but PC based
Objective: Establish LIS where cadastral and terrestrial resource databases can be linked via (parcel) index system.

Fiji - Native Land Trust Board (since 1986, with American and Australian consultants)
Project: NLTB-LIS (Land use Planner)
Hard/software: DEC-equipment, Mini/PC, Info-map
Objective: Building digital database for all native land areas and their attributes to support NLTB registration tasks, 83% of all Fiji land is native land.
Problems: Lack of standards, input data of variable accuracy. Little coordination with other departments. Lack of professional skilled staff

Fiji- Mineral Resources Department (since 1988)
Project: Computer management support
Objective: Continuous computer support through out all departments, especially graphic output.
Hard/Software: Macintosh + server and network, including PCs in network. Database and graphic output.

Fiji - Department of Land and Survey
Project: Pilot study on Ba catchment area, involving all relevant departments.
Objective: Introduce RS techniques to different departments
Hard/software: PC, MicroBRIAN
Problems: Lack of awareness. Access to funds for training and digital data purchase (images).

PNG - Department of Land and Forest (since 1988, with CSIRO)
Project: PNG Resource Information System
Objective: create GIS for land use management, assessment of potential for food crop and export crop production. Resource mapping of PNG at 1:100,000 scale.
Hard/software: PC AT-based, non graphic database
Problems: Data model not yet suitable for practical policy support. Training of users required. Graphic capabilities still weak

Solomon Islands (1986, by DSIR)
Project: Hazard assessment using R.S.techniques
Objective: Assess cyclone Namu damages
Hard/software: PC-EPIC RS software
Problems Difficulty in access to existing images in the region.

Solomon Islands - Ministry of Forests (since 1989)
Project: Computerised resource inventory
Objective: National forest resources mapping at 1:100,000
Hard/software: PC-AT, Fox-pro and Map-Info
Problems: Lack of skilled staff, and access to data

Vanuatu - Department of Forestry
Project: Computerised forest inventory
Objective: National forest resources mapping at 1:100,000
Hard/software: PC-AT, FoxPro and Map-Info
Problems: Lack of skilled staff, and access to data

Western Samoa - Ministry of Lands (since 1989, with DSIR)
Project: Land capability mapping
Objective: Land use capability for food crop planning and erosion control.
Hard/software: IBM-AT, PC-ARC/INFO
Problems: Lack of hardware, lack of trained staff, difficult access to equipment, data competence problems

French Polynesia - SMA/EVAAM (since 1989)
Project: Black pearl farm mapping and registration
Objective: Management of lagoon's capacity to host black pearl culture.
Hard/software: PC-AT. Microstation-informix

Other activities in the field of spatial data handling, but at a more scientific or educational level, can be found in PNG UNITECH and Tonga. Unfortunately, specifications of these activities could not be obtained during the course of the mission.

This list, by no means complete, could be complemented with a large number of organisations that use computers for non-spatially referenced database handling. Many of these organisations are holding data that, in the context of a digital land information system (such as proposed for Fiji), could be linked to land-related information.

The list shows that digital (geo) data handling has already been introduced to many SPC member countries in support of their resource administration and management tasks, and to contribute to regional programmes such as SPREP.

1.6 The use of GIS and RS in regional organisations

Regional organisations such as SPC, FFA, SOPAC, SPREP, USP, and ESCAP/RRSP, have to various degrees used computer technology in recent years. The RRSP has stimulated interest in RS techniques and built up a network of people who wish and need to apply these techniques. However, computerised RS image processing facilities are so far only found in Tahiti, New Caledonia, New Zealand, Australia and, to a lesser degree, PNG and Fiji (SOPAC).

The SPREP-GRID programme, which is expected to start in the near future, will facilitate software acquisition and training on GIS. The programme will work with Environment Departments or Environmental Units in Pacific Island countries. IDRISI software will be given to these departments to handle the geo database. Work for the GRID programme will require systematic surveys of resources, probably involving RS.

The SPC Fisheries Programme, which is among the most experienced in database management in the area, is running a large database which is shared with FFA. This tuna and billfish database encompasses fishing fleet catch-effort data and experimental fish tagging data, all of which is geo-referenced. For inshore fisheries research, the Fisheries Programme is concerned with coastal reef and lagoon mapping and usage, in which traditional cartography is limited. Full GIS and RS capabilities would greatly enhance the many of the research areas of the Fisheries Programme whilst improving the presentation and usefulness of existing marine data.

SPC also applies digital data analysis techniques through its Economic and Statistics programme. Here mainly spreadsheet programs are involved. For project development, SPC uses geo information which it may also produce, especially if the scale or detail of available information is not sufficient for project planning and execution. RS and spatial analysis techniques have to be used. The PAIS project will build up a digital database which will require training to operate and maintain. Although it is not clear yet what the structure of the database will be, it will have some of the characteristics of a GIS.

USP, SPC, FFA and SOPAC are participating in the PIMRIS project, a digital bibliographic database on marine resources. SPC and USP libraries are assisting local libraries in the island states to build digital catalogue systems.

USP, which has its own computer department, is introducing GIS techniques in its curricula. Presently the GIMMS mapping software is being introduced to the geography department. SOPAC has PC-based digital RS facilities and can also handle databases with graphic output capabilities (on VAX).

ORSTOM and SPT provide services in digital RS techniques. DSIR, CSIRO, AKCLIS and other organisations also have ongoing commitments in the region for this type of support.

1.7 Specification of Problems

The introduction and use of modern techniques cause specific problems. These problems can be of a technical, economic, manpower or managerial nature. Many countries and some regional organisations experience these problems and encounter difficulties in solving them.

1.7.1 *Technical problems*

- The services for updating and maintenance of hard and software are not readily available, especially in the first phase of the use of systems.
- The configurations are not suited for the tasks.
- Systems are incompatible in the same (national) environment.
- Inadequate attention has been given to data definition and database design.
- Systems are set up for research and demonstration, but not for production work.
- Data are not available in a usable form.

1.7.2 *Economic Problems*

- Initial investments in hardware and software, especially for GIS systems, tend to be high.
- The budget for maintenance and upgrading of hardware and software is under-estimated or even forgotten.
- The benefits from the new technology have been over-estimated, especially in the short term.
- The cost of manpower training is high, both directly, and in terms of lost productivity if staff are trained outside.

- After being trained, staff often do not return to their agency, which results in a loss of time and money.
- The cost of data entry in a system tends to be very high and is generally underestimated.
- The cost of data maintenance is high.

1.7.3 *Managerial And Manpower Problems*

- Lack of knowledge about location and availability of data sets.
- As systems tend to be established as research tools, no careful analysis is done of information requirements.
- Most organisations introduce computer systems before an information and automation plan is made.
- Individuals that can operate systems are in high demand on the labour market and may change easily for other employment, leaving the organisation with a lack of skilled personnel to keep systems running.
- Training facilities are generally available abroad, but the capacity to send people for training cannot keep up with the demand for trained people in the organisation.
- Data sharing among organisations reduces control over the use and interpretation of data and gives rise to disputes about its ownership and price.
- When organisations decide to join data sets, a certain level of duplication and overlap on data collection can become apparent. This might lead to a redistribution of tasks among different organisations, affecting the traditional competencies.
- Successful linking/sharing of data can only be achieved if data definitions and exchange standards are established. This must be done by joint committees and practice shows that this is a very time consuming and sometimes painful operation.
- Introduction of computer technology can give rise to increased status and power of generally younger employees. This can be felt as a threat by older (management) staff who have not been trained in the technology.

Certain donor agencies, such as AIDAB and ESCAP, have realised that the introduction of modern techniques is happening in an uncoordinated matter. They wish to prevent duplication of programmes, and for that purpose will organise a workshop in March 1991, in Suva, Fiji.

1.8 Suppliers of GIS and RS technology in the South Pacific

The South Pacific region includes countries with a long and outstanding experience in the development and use of spatial information technology. Organisations such as DSIR, CSIRO, several universities and the national survey and mapping agencies of Australia and New Zealand belong to the pioneers of GIS developments. The technology has been applied in different areas, ranging from cadastral mapping and land registration systems to natural resource mapping and monitoring in land and sea areas.

The South Pacific area also comprises institutes specialized in the use of RS techniques, ranging from air photo interpretation to digital satellite image processing. These include AKCLIS, DSIR, AUSLIG, ORSTOM, SPT and SOPAC, among others. These institutions, as well as private enterprises, can be considered as qualified suppliers of services and equipment in the field of GIS and RS technology.

1.9 Conclusion

Modern technology for spatial data has already been introduced to the region. Access to data to be processed with this technology is a serious constraint.

A great deal of land- and sea- related data is handled in digital form. Computer graphics, GIS and image processing software are increasingly important. Bilateral, regional, and national programmes are stimulating automation.

The problems encountered in the transition from an analogue to a digital environment are of technical, economic and managerial character. They include problems with hard and software maintenance, capture of data, training of personnel, the efficient use of information in organisations, and inter-institutional cooperation for data sharing.

Many data on the Pacific Islands are held in developed countries. Some institutes are experienced in the use of GIS and RS. Several donor agencies and international programmes are supporting, or willing to support the development of GIS and RS in the Pacific. Some donor agencies recognise the risk of duplication of projects aims and want to prevent this.

As communications are difficult and developments in the techniques of GIS and RS are happening quickly, it is not easy to know whom to approach to solve problems. For the Pacific countries a regional institution would be the most appropriate to maintain a network of contacts between those who are experiencing problems and those who can solve them. In the central node of this network, information should be available on the supply of services equipment, data and funds. This central point could act in matching the demand with the supply and give a stimulus for standards, so that exchange and aggregation of information can take place.

As a regional organisation covering all island states and territories and some important suppliers of digital techniques, SPC is in an ideal position to harmonise the development process. A programme to support the transition to modern techniques for the handling of spatial information should be established, and this mission considers that SPC would be an appropriate agency to house such a programme.

More details of the approach being proposed are given in Section 3.

2 SPC's INTERNAL NEEDS FOR DIGITAL TECHNOLOGY

The terms of reference for the mission state that it should investigate how SPC and its programmes could benefit from geo-information technology, including remote sensing. The mission therefore interviewed representatives of all programmes and investigated how present work procedures could be best supported by spatial digital techniques. The wishes of the programmes for future processing were also noted.

The different components of SPC were grouped in 4 classes, as follows:

- Management;
- Work programmes;
- Continuous information handling activities;
- Service departments.

Each of these classes has different requirements for geo-data handling and automation:-

2.1 Management

The use of GIS and RS techniques is underdeveloped in SPC. The internal efficiency of the organisation would benefit from application oriented use of GIS/RS technology. Programmes would also benefit from an "Electronic Atlas" of the region, within SPC.

Management has left the decision for the introduction of digital techniques to the individual programmes. Management should ask for an information/automation plan for the coming years (see below).

New staff to be contracted should have some knowledge about, and experience with GIS/RS use. Present staff and management would benefit from an in house training workshop on this field (see below).

2.2 Work programme

This group comprises: Coastal Fisheries Programme, Women's Programme, Health Programme, Nutrition Programme, Rural Technology Programme, Agriculture Programme, Economic and Rural Development Programme. The common feature of these programmes is that they work mainly on short term projects, and that they elaborate projects on an ad-hoc basis when a request is received from a member country. In the elaboration of a project, the assessment of the physical resources generally plays a role in problem identification. The analysis of the causes of the problem (through spatial analysis) and the assessment of the resources potentials are also reviewed. Traditional thematic and topographic map information is used.

Where there is no map information or where available map is not sufficient, (accurate or up to date), RS data and techniques can be used to obtain rapidly this information. So far the inshore fisheries programme has effectively used RS techniques on an ad-hoc basis with support from ORSTOM. GIS/RS software could be used efficiently in the project elaboration to speed up procedures and improve the quality of the project definition.

PC-based software which provides spatial analysis, image processing and some database with mapping facilities, could efficiently help most of these programmes. The mission therefore recommends that at least 2 GIS software packages with these characteristics, with an introductory user support, be purchased for use by these programmes. A "hands on" training workshop should be given to the potential users.

2.3 Continuous information handling projects

This group comprises: Statistics Programme, Demography Programme, Plant Protection Programme, Library, Tuna and Billfish Assessment Programme (TBAP) and South Pacific Regional Environment Programme (SPREP). These programmes have in common that they repeat procedures. The statistics and demography programmes introduce standards in countries for the national statistical and demographic accounts. In addition, they process the national data to aggregated regional data. Computer technology is used in both programmes, so far without geographical specifications or mapping. Plant Protection and the Library are concentrating on digital catalogue systems in which no computer graphics are used.

Within the Demography Programme great interest exists in introducing more detailed spatial referencing on the data sets and do more in depth demographic analysis using physical characteristics of the countries (e.g. to investigate the relation between population densities and land-potentials). GI software is required for such analysis, and PC-based software could be used.

The Statistics Programme has so far not used any mapping, although statistical publications would benefit from some graphics. The mission suggested the employment of simple computer graphics software (Atlas Graphics, Map-info). They can easily be attached to spreadsheet programmes to produce this type of graphic output in the future.

The TBAP runs a large database in a very efficient manner. It is the unit with most computer experience in SPC. So far only limited graphic output has been produced through in-house developed software. As well as mapping catch patterns, and the movements of tagged fish, spatial analyses could play a role in further fisheries research (such as to investigate the relation between bathymetric data, catch data, temperature data, current patterns, *etc*).

As the detailed data are not yet available for this type of research it has not yet been done, but it can be expected that the programme will go into this type of spatial analysis in the near future. The mission suggests that it be done in consultation with ORSTOM, as it will include large satellite data sets (NOAA, MOSS, SPOT-2, ERS1).

The fisheries programme could use as PC-based GIS-software to do the analysis and modelling. PC-based image processing software would be required for the preparation of the data to be integrated in the GIS.

SPREP will require more data collection to assess natural resources in the countries. Since monitoring is an important element in environmental policy, data collection will be repetitive. RS techniques will be required to provide new data on regular basis.

Once collected, the data have to be stored and processed. In the SPREP/GRID/UNITAR, proposal hard and software will be made available to the environmental units in the countries and training be provided. So far, the SPREP programme and the environmental units have not made much use of these techniques.

The mission fully supports the importance of environmental monitoring and the assignation of the SPREP programme as a regional node in the GRID environmental network. The use of digital techniques can be fully justified but the mission foresees that a successful SPREP programme in the South Pacific requires more than a simple training course at the start of the programme.

The requirements for SPREP in-country activities are similar to those already described (support in system maintenance, information analysis, database design, and standards). These requirements could be met through the SPIDER network.

For the central SPREP office there will be the task of aggregating national data sets to regional sets and maintain the database at this level. Accepted standards are therefore a prerequisite. The central SPREP office will also have to perform spatial analysis on national and regional data. It will, thus, require good GIS capabilities and skills including and image processing capabilities. For the short-term these requirements can be met with the hard and software and the training provided by UNITAR.

The mission recommends that for successful implementation of the SPREP programme further support should be given. The SPREP programme would benefit greatly from SPIDER, which could also support SPREP's central office for data handling and processing. The training component in SPIDER must complement the training initiated by UNITAR.

SPIDER and SPREP must work closely together. SPREP though, limits itself to the collection and processing of environmental data. SPIDER should provide the support to the entire information/ automation problem which goes beyond environmental data.

2.4 Service Programmes

This comprises: Publications Section, Finance Section, Administration Section and Computer Services Section. The Publications Section has begun to use computer graphics tools recently. Publications staff stressed the importance of the use of graphics (maps, diagrams) in the reports prepared by the different programmes, and would be glad to see more maps and graphs produced by the programmes for inclusion in publications.

The Finance Section is using a mini-computer and, in the Administration Section, a project is under development to automate the registration of all incoming mail.

The Computer Services Section provides hardware and software support to the SPC's programmes. The TBAP has its own computer manager while the others rely on the computer service manager. However, so far all systems work separately and programmes have a large autonomy on hard and software specifications. The effectiveness of the existing Computer Advisory Committee has been limited.

The mission suggests that the Computer Advisory Committee, possibly expanded with some members from the Work Programme, should develop an information plan and corresponding automation plan for the coming years.

2.5 Conclusions on current use of geographical information in SPC

GI software is not yet used in SPC and little is known about its capabilities by the majority of programme staff. The ad-hoc project work would benefit from the use of GI and RS software. More analysis could be done by the demography, health, nutrition, agriculture and fisheries programmes with GI software. They all could use mapping facilities for better output. All this can be done with PC-based software.

The level of co-ordination between the programmes in SPC on hard and software acquisition and data handling is low. An information and automation plan, reflecting the needs of the programmes is missing.

SPREP, though no longer a part of SPC, is giving a strong impetus to digital geo-information handling, both in the countries and within the SPREP office. The SPREP programme has to define data requirements and specifications, and design the database which it wants to keep at regional (aggregated) level in order to function as the regional GRID-node. The UNITAR-training programme cannot cover all these items. SPREP will therefore need in-house staff with good geo-information experience and the support of SPIDER.

2.6 Suggestion

Once the SPREP environmental data GIS comes into operation it can provide to regional organisations such as SPC an important part of the (aggregated) resource information of the SPREP member countries.

When data standards are defined it will be possible to grow within SPC towards a network of databases maintained by the different programmes and in which data (at aggregated levels) can be linked. This could become an 'Electronic Atlas' of the South Pacific countries (e.g. containing the administrative boundaries, the corresponding demographic and statistical information, the major vegetation classes, terrain mapping units etc). Copies of this 'Atlas data set' could then be distributed more widely in digital or hard copy.

2.7 Recommendations for improved GI-handling in SPC

- Install a PC-based GIS with some image handling capabilities for common use by the interested programmes for analysis and modelling.
- Install 1 PC based image processing system with peripherals to do project and monitoring tasks and prepare sub-sets to be used in the GIS systems.
- With the introduction of these systems, organise three workshops for SPC staff to improve their knowledge on geo-informatics, image processing and database design, and give hands-on training on the systems.
- Form a working group to prepare an information and automation plan for the future.
- Consider within the information plan the creation of an 'Electronic Atlas' composed of data held and aggregated by the different programmes (SPREP, Fisheries, Health, Statistics, Demography, Agriculture etc.).
- Establish a memorandum of understanding with ORSTOM for support on request in the use of the RS facility at SPC.
- Strengthen the contacts between the programmes through regular technical staff meetings with SPC Management.

3 THE SOUTH PACIFIC INFORMATION DEVELOPMENT AND EXCHANGE OF RESOURCES (SPIDER) CONCEPT

3.1 Description of Programme

The general objective of the proposed SPIDER programme is to assist South Pacific countries and organisations in solving problems related to building up adequate resource information, and in the introduction/use of digital techniques (RS and GIS) for resource mapping, administration and management.

For its operation the programme needs a network of contacts with people and organisations. To maintain contacts the network must have a focal point to which members can address questions or offers, and from which stimuli can be given to the members, or "nodes". The first specific activity will be to create this infrastructure for the functioning of the programme.

To achieve the overall goal the programme must address a series of specific problem areas and associated specific objectives.

- *Meta-Database*

  To facilitate access to existing data on land and marine resources, information on scientific and technological developments in the field of GIS and RS, and information on financing opportunities, through a meta-database (*i.e.* a database containing information on other data sources).

- *RS Techniques*

  To re-activate the network organised by the RRSP and expand it to promote the increased use of RS techniques. This will give access to new resource data and strengthen interaction between national departments and regional/ international agencies.

- *Advisory Service*

  To provide a "trouble shooting" service, and to stress the importance of system development methods, information analysis and information- and automation-planning before digital geo- databases are structured and implemented.

- *Standards*

  To stimulate the establishment of standards for data exchange and for the aggregation of national data sets to regional data sets.

- *Training*

  To stimulate training programmes at all levels (managerial to operational) in GIS and RS technology, and to assist in and support existing training programmes.

- *Follow-Up*

  To follow up the operation of GIS implemented in resource management organisations so as to assure or improve the usefulness of information.

- *Advice and support to the programme*

  To guide and keep the programme up to date in such rapidly changing area of activity, a Technical Advisory Committee is strongly needed.

A detailed description of network and the specific problem areas, is given in the following paragraphs.

3.2 The Network

A network is composed of lines of communication between nodes. Networking is the establishment and activation of these lines. The networking activity in the SPIDER programme must be the establishment and maintenance of strong links with all national, regional and international bodies active in the area dealing with spatial information and digital spatial data techniques. The network must have a focal point to which messages and questions can be send, which performs a clearing house function and activates the nodes in the network. This focal point should be established as an office at SPC with a staff of 2 experts and 1 secretary.

At the focal point a meta-database should be implemented to support the clearing house functions. A description of the content of this database is given below.

The focal point should provide a series of services.

- Maintain the meta-database and give free access to it.
- Promote information dissemination and the exchange of expertise.

A newsletter service should be provided, diffusing information on updates of the meta-database and new developments in the area of GIS or RS. It should cover new equipment, new studies, agenda of educational opportunities, new service suppliers in the region *etc.*

The focal point should also encourage and coordinate data and expertise exchanges, as well as performing the secretarial tasks for a Committee for Standards, when established.

3.1.1 Advisory Service

Provide a problem diagnosis service to help GIS/RS users with trouble-shooting and identification of causes of major break-downs. If necessary, SPIDER should help to find a suitable supplier of services to solve the problem.

The focal point should provide impartial advice, on request, at managerial and technical level, to support geo-information projects and RS projects, from the stage of drafting proposals to the accomplishment phase of a project. The elements which need special attention in projects are discussed below.

3.1.2 Budget for consultancy services.

As a result of the" trouble shooting" and advisory services the need for a consultancy by a third party might arise. The focal point should control a budget which can be used to carry out these consultancies.

3.1.3 Training design and fellowships.

The focal point can help specify the terms of reference for training programmes and evaluate them. The focal point should control a budget from which training consultants can be (co-)financed and fellowships can be given to attend training programmes and courses (see 5).

3.3 The Meta-Database

A meta database is a database which holds information about the information itself. It does not have the original data but can tell potential users where and what the accessible data are. This type of meta databases is set up for the area of RS and GIS in many countries all over the world.

The meta-database for spatial information should contain information about existing data sets: ongoing programmes and activities in the area and organisations involved, hard and software and technological developments, donor agencies and consultants, and training opportunities.

To obtain up to date information over the region, key persons in the various participating agencies (nodes) are needed. Through their information, SPIDER will be able to co-ordinate and advise efficiently.

There is a lot of environmental resource information available in and about PINs. In addition to the results of work carried out in each country by their respective resource agencies (traditionally agriculture, fisheries, forestry, planning and, more recently, environment), much information was obtained by Australian, British, French and New Zealand agencies. Recent activities by aid and non-governmental organisations have added to the amount of data available. Many studies and original materials are also available in universities.

Much of this information is in spatial form at various scales and with different map projections, and may consist of air photos, maps and documents, and satellite images. For instance DSIR, CSIRO, ORSTOM, DOSLI, AUSLIG, and the Military archives in Australia and New Zealand, all have air-photos and maps of PINs. Some of these go back 50 years and are highly relevant for monitoring studies.

However, the information is widely dispersed throughout national and international agencies and institutions. It is not always readily accessible for use in resource planning and resource project development.

The focal point should make an inventory of this material and assess the conditions for it use (price, conditions, confidentiality, ownership and copyrights). The database must also contain information about past and presents projects in spatial data collection and processing in the area, the parties involved, etc.

The database must contain information on hardware and software, and the names and addresses of institutions and firms that can service them. The database should also keep records of all donor agencies that are involved in spatial data handling projects, availability of funds, project proposal, formats and conditions for project presentation.

It should be noted that, apart from its technical importance, the database would be of great value to regional organisations and donor agencies since it could provide information on duplication or complementarity of requests for funding.

3.4 Remote Sensing (RS)

3.4.1 Use of RS

For the purposes of this section the term "RS" includes both the traditional and new uses of conventional aerial photography as well as the use of satellite image interpretation. RS has considerable application for mapping the environmental conditions prevailing in the Pacific. The effective transfer of the technology to the resource agencies has not yet been fully achieved.

There are significant and recurrent difficulties in ensuring consistent and timely delivery of acceptably accurate and appropriate information on the quality, quantity and distribution of resources and their use. These constraints are caused by limited operational capacities to acquire data, and by shortages of staff trained in both manual and computer assisted processes to interpret and present the acquired information in a form useful to decision makers. These problems are best addressed on a regional scale.

3.4.2 Present Status of the Use of RS in the PIC

Some countries in the Pacific (notably the Cook Islands, Fiji, French Polynesia, New Caledonia, Papua New Guinea, the Solomon Islands, Western Samoa and, to a lesser extent, Vanuatu) have considerable internal capacity to acquire conventional air photos and use them in the preparation of topographic maps. The transfer of this capacity from the lands and survey areas to respective resource departments has been limited.

Other countries have only a limited capacity to use even aerial photography. The constraints are generally financial (no capacity to acquire new photography), technical (very limited equipment and very few staff with the necessary training and skills), and/or perceptual (low appreciation of the value of photography as a means of recording conditions and measuring changes).

A few countries - Cook Islands, Fiji, French Polynesia, New Caledonia, Papua New Guinea - have some limited experience with satellite imagery. LATICAL (New Caledonia) and SPT (French Polynesia) also increased their activity in RS and demonstrated a number of applications, particularly with respect to shallow water and coastal feature mapping at the recent "Pix-iles" RS Workshop. Only SPT has automated some of the processes.

Australia, France and New Zealand carry out a range of air photo and RS programmes and could support applications, services and training activity needs in Pacific countries.

During 1988/90 there was a significant increase in interest in the use of RS in national agencies and regional organisations. The SPC Coastal Fisheries Programme, FFA and SOPAC indicated interest in the technique. SOPAC particularly carried out a number of pilot evaluations successfully demonstrating the utility of RS to its operations.

The regional agencies (SPC, SPREP, SOPAC) have identified a need for small image processing capabilities to support project missions, planning and mapping. There is a parallel need for training, project support and advisory activities in member countries. Project types include support for coastal management, watershed erosion and sediment studies, agricultural assessment, plantation monitoring, *etc.*

The ESCAP/UNDP RRSP was active between 1988 and 1990. It assessed the state of RS in the region and found (ESCAP, 1990a) that:

- there were significant differences between the countries of the region in their needs for RS including air photo interpretation, training and facilities;
- there was considerable disparity in the limited numbers of trained technical and professional staff, facilities, basic access to data, levels of application and acceptance of the technology;
- there were few nationals with graduate level qualifications in RS, geographic information systems or computer aided mapping, and most of those are in Fiji or PNG;
- there are only a handful, again only in Fiji and PNG, micro-computer based image analysis systems - at the same time there was an increase in the number of potential geographic or computer aided resource information systems;
- staff who have attended training in more advanced image analysis and geographic information system applications faced a major constraint on their return in the lack of comparable equipment and facilities;
- a number of countries require assistance in setting up basic air photo archives with minimal analysis equipment and there was a concurrent need for the in-country training of existing and potential users.

The findings of the UNDP/ESCAP RRSP workshop on *"Remote Sensing for land and sea resource survey and evaluation in the Pacific: Applications, coordination and training"* (ESCAP, 1990b) are particularly significant in that senior level technical representatives from SPC member countries strongly recommended that special efforts be made to develop a sustained training, education and project support services programme in air photo and RS applications to resource management, and that related manual and computer assisted GIS applications be developed for PINs. This recommendation was endorsed by the final report on the Pacific sub-programme (ESCAP, 1990a). In-country courses and seminars (Tonga, Fiji) also stressed the need for the greater adoption of the technology, its integration into existing resource planning, and for training of staff.

3.4.3 SPIDER and RS

The RRSP established a network and increased interest in RS in the Pacific. Recommendations were made to ESCAP to continue a specific Pacific focussed programme based in the region but, to date, this has not eventuated.

Since the closure of the Sub-programme there is no agency or programme co-coordinating such co-operative action, in the development of RS applications in the Pacific. It would appear that such a network, based in the Pacific, would be of value.

The network established by the RRSP could form an important part of the SPIDER network. A proposal could be made to ESCAP to continue the work started by the RRSP, in the SPIDER programme and to recognise and support the SPIDER focal point.

The SPIDER programme covers all aspects of spatial data collection and processing. By incorporating specific RS activities in the network, this activity will be integrated in the entire process of spatial data collection/processing. Thus, it will be taken out of its slightly isolated position.

By establishing some image processing capabilities in SPC (see chapter 3) through the SPIDER programme, support can be given to countries which have not reached the technological level and/or the critical mass to implement RS/GIS projects. The programme will have to encourage the use of RS/GIS and make resource managers aware of the usefulness of such new technologies by demystifying them.

Geographic information systems have a role in storing and manipulating spatial data for use in development planning. However, before this can be done it will be necessary to prepare the data for computer entry. This is a large and sometimes complex task. It may be beyond the capacity of some countries of the region to achieve, without external financial and technical assistance. SPIDER should then provide this assistance.

3.5 Advisory Services

Serious problems arise when digital databases are implemented at great costs and efforts, but do not respond to the user's requirement for information. System development methodologies help to get things done in the correct order during implementation of new technology. The first step is to define an information plan in which the organisation specifies its objectives for handling information. Information analysis is a technique to assess the flows of information in an organisation and the use of this information. After assessing the flows, exact data items which will have to be stored in a database can be identified. Information analysis can highlight duplication and redundancies in organisation, prevention of which leads to cost savings. Once the information analysis is completed, there exists a clear view on how data have to be combined in order to produce the required information. The database can then be structured in the correct way.

In the technology-driven enthusiasm to introducing GIS, this phase of system design and information analysis is easily forgotten. As a result large amounts of money invested do not become productive. The Pacific countries should not repeat the mistakes made elsewhere. Information analysis and data base design procedures, must be part of any project for the introduction and use of digital techniques.The SPIDER network should make institutions aware of this need. SPIDER staff should assist and critically watch over these aspects in project proposals and execution. In the same way SPIDER should assist SPC for its internal needs with an information and automation plan.

3.6 Present status in the South Pacific region.

The national Survey and Mapping Agencies in Australia and New Zealand have made big investments in digital techniques to support their information and map production. DOSLI now recognizes that there was an over-investment in equipment and data entry due to a lack of information planning and analysis (verbal communication, G.Grocker).

Research institutes such as CSIRO and DSIR have not assessed the effectiveness of their investment and projects. As research organisations they could depreciate investments quickly. However, the amount of money spent on implementing geo databases at a national scale is very large in comparison to the limited use which has been made of them so far. Many state organisations in Australia have installed equipment,which has not become sufficiently productive due to a lack of planning and incorrect technical specifications (D.Kuchler, Pix-Iles Conference, 1990).

In Fiji serious problems are arising with the design of the FLIS (Fiji Land Information System) due to uncoordinated automation and disputes about competence in data sharing. In Western Samoa a Land Use Capability database was implemented, but apparently a lack of co-ordination between departments makes it unusable. In PNG the resource database (PNGRIS) is not yet providing answers which are relevant now. With a better information analysis this situation might have been prevented.

In most cases the introduction of systems in organisations has a strong research or pilot project character. To make systems cost effective they should be oriented towards production work. This is best done by following system development procedures, as well as by introducing these into ongoing projects. The SPIDER programme must, as part of its advisory and information diffusion service, increase the awareness for this need in the region.

3.7 Standards

So far the introduction of digital techniques has taken place through small, uncoordinated programmes. Automation has started, like everywhere else in the world, as little projects in organisations. The result of this development is that a wide range of hard and software is used and that data definitions for the same type of objects can be very different between countries, organisations or even within organisations. This becomes a problem when, as a logical step in the development of automation, data sets are combined into larger databases or networks. Then the following problems arise:

- hard and software configurations of different organisations are not compatible,
- the data definitions are not compatible,
- there is data redundancy and duplication in collection,
- data maintenance is not taken into account,

- authority over data, copyright and the price of information have to be settled,
- institutions are not used to or prepared to share data.

If different organisations classify the same objects in different ways, data sets cannot be combined or aggregated (*e.g.* if in two provinces the vegetation is classified in a different way, then an analysis of vegetation passing the border of the province will cause problems). When national data sets have to be aggregated to regional data sets, standards must be accepted throughout the region.

This type of problem, which is occurring in many countries and regional organisations over the world, can only be solved if a top level decision is made to introduce standards for data exchange and data sharing at the operational level. If no co-ordination at a level "above the parties" takes place, the dictating of standards will be done by the organisation with most economic and/or digital resources. In order to impose standards, these organisations tend to duplicate the work of others to get all data in their system. In practice this leads to an enormous waste of resources and unsatisfactory levels of data sharing.

Standards relate to:

- geo-referencing of objects,
- identification and classification of objects,
- description, data dictionary,
- accuracy, reliability, dating,
- data formats (digital).

In the South Pacific region, where computer technology is being introduced rapidly, it seems appropriate to agree quickly on such top-level co-ordination of all levels where regional data sharing and technology support has to take place. SPC is a regional organisation covering all island states and territories and some important suppliers of digital techniques. It is, in the opinion of the mission, the most appropriate institution to establish such co-ordination.

Through the South Pacific Conference, the focal point in the SPIDER network should take initiatives to form a committee which can define standards and perform the technical secretarial tasks of this committee. The SPREP programme will need standards on natural resource data in the near future. SPIDER and SPREP should co-ordinate in this matter. Experience with this type of committee exists in Australia and could be applied for the benefit of the region. The meetings of the Standards Committee will also be an important platform for exchange of GIS and RS experience and discussion of new initiatives. The mission considers the creation of the committee as a very important part of the SPIDER programme.

3.8 Training Activities

3.8.1 Need for Training

The most serious limitations to the effective use of RS and GIS applications are :

- the scarcity of technical and professional staff with the appropriate skills; and
- the lack of awareness amongst senior management of the benefits of geo-coded information handling to resource planning and management.

Training is required for professional staff in the resource and planning related agencies in the role and use of RS data interpretation and GIS applications. Training also needs to raise awareness of the benefits of the technology to improved planning and management and provide opportunities for senior management to learn how to incorporate the technology within their agencies.

Programmes for training must be designed for the practical requirements of government agencies, and as far as possible, should be associated with projects designed to meet the information needs of operational agencies. Without training there will be continued and increasing dependence, on technical specialists and consultants from the developed countries. This dependency will incur the transfer of national and aid funds from the developing country to developed countries and will not promote self-sufficiency.

(a) Present Training in the Area

Specialised agencies which have expressed interest in the extension of geo-information technology include:

- United Nations Environment Programme (UNEP)
- United Nations Food and Agriculture Organisation (FAO)
- UNDP/ESCAP regional RS Programme (RRSP)
- South Pacific Applied Geoscience Commission (SOPAC)
- Papua New Guinea University of Technology (UNITECH)
- University of the South Pacific (USP).

Only the RRSP, SOPAC, USP and UNITECH have carried out any form of regular training or educational activities. The training that is carried out is generally specific to a particular project component and is rarely sustained. There has been little direct multilateral donor support for geographic information and RS technology transfer and training in the Pacific. A limited contribution was made by UNDP through the ESCAP executed RRSP South Pacific Sub-programme. In June 1990, RRSP established a network foundation for RS and allied technology training which can be used to effect in any proposed programmes.

Bilateral donors and programmes tend to support discrete resource survey activities and technology transfer projects. Any training is usually part of a specific project, and not sustained beyond the projects life. Sustained education and training programmes focussed on GIS and RS have received little direct attention.

The proposed UNEP Global Environment Monitoring System (GEMS) Global Resource Inventory Database (GRID) programme activity, directly targets environmental monitoring and assessment data management. It will, if approved, include an active training and technology transfer programme. The UNEP/SPREP/GRID project is of considerable importance to any proposed SPC activity in the GIS/RS field, as it could cover much of the identified training requirements in the short run, although it might fall short in the longer term.

SOPAC is investigating the use of RS and GIS in the operation of its work programme. Applications are limited to geological and coastal (shallow water), engineering and geological resource mapping, but includes training in survey techniques, air-photo interpretation and cartography.

(b) Educational Institutions

There is an urgent need for regional tertiary institutions to introduce geo-information concepts and technology applications at undergraduate and graduate level degree programmes. USP and UNITECH have both shown interest in RS (primarily) and GIS applications. USP is of particular interest since it is a regional university operating through 11 countries of the SPC region. Apart from the two main campuses in Suva and Apia, it maintains 8 University Centres, one in each participating country. It supported the UNDP/ESCAP RRSP by providing office space and infrastructure.

The University of Guam has recently introduced RS as an undergraduate course option. The Universite Francaise du Pacifique (UFP) co-operates with both the IFREMER/French Polynesia RS Centre in Tahiti, French Polynesia, and ORSTOM/LATICAL RS laboratory in Noumea, New Caledonia. It hopes to offer training and university level courses in RS. The University of Queensland, Brisbane, Australia, and University of Auckland, New Zealand, have both indicated interest in providing training in the Pacific.

The Australian Key Centre for Land Information Studies (AKCLIS), has already conducted training in RS applications for land and sea resource survey in association with RRSP and SOPAC. The centre has a Memorandum of Understanding with USP's Institute of Natural Resources to support joint research, education and training in GIS and RS in the region.

Although activities in geo information technology in the Pacific are increasing rapidly, there are some major constraints imposed by the scarcity of regional training and educational opportunities and, consequently, the limited number of staff with the necessary skills. A regional training programme could have a significant impact on geo information applications in the Pacific.

3.8.2 Requirements for Future Training

Any training effort must be carefully designed to address different target groups at the appropriate level. It must use material and approaches relevant to that group. There are two principal target groups:-

a. Indirect Users

Upper management is an indirect user of the technology but a potential major user of the results of geo information approaches and technology. Managers need to be made aware of the value of the technology, and the cost efficiencies to be gained. Topics would need to include management of information, cost/ benefit assessments, etc. These people may also be in non-resource agencies, such as Finance or Economic Planning.

b. Direct Users

Direct users include:

- professional and operational staff concerned with the information retrieval and analysis of spatial data for areas of planning and management. These people need to know how to apply GIS/RS in their area of specialty for information gathering, assessment and analysis issues. They must be able to understand and use the overlay and modelling capabilities of the system;

- technical level staff who may have to directly use the software and hardware on a day to day level. They need to know how to operate the hardware and software packages, information entry and retrieval, maintenance of equipment, *etc.*

In many PINs, technical and resource professional staff may be the same people.

As indicated above current training and education opportunities are limited to specific project and diploma and degree studies in tertiary institutions outside the region. A regional programme to advance skills in geo information technology in the region would need to provide support for training and education. Possible areas for action include the following:

- "on the job" training programmes (apprentice-ship schemes) - development of acceptable curricula, standards, components, and duration. Training materials design and development.

- agency or service specific courses either in conjunction with apprenticeship schemes or "stand-alone".

- in-country training courses, seminars and workshops with introductory or awareness raising contents aimed at saturation training to create a critical mass of expertise in each country. Courses should have local content and be aligned to existing information needs and country programmes. Development of such courses implies the need for a standing team of training/seminar specialists working on a "mobile training course" concept.

- external (regional courses) specifically designed for Pacific conditions; short to medium-term (less than 3 months) courses in advanced or special topics for persons with an acceptable level of basic skills and knowledge; re-training in specialised topical areas. Ideally such courses would be provided by regional tertiary or technical institutions, but could be implemented or sub-contracted through regionally funded programmes. Access to teaching skills and equipment would be needed.

- work experience placements with relevant specialised institutions outside of the Pacific - usually only for persons with considerable level of skill, who could benefit from experience in an operational agency.

- provision of opportunities, including assistance in selection and placement, to qualified individuals either from within or outside the service to attend tertiary training. (diploma or degree level studies).

- encouragement and assistance to tertiary institutions in the region, in the introduction of geo information techniques and technology topics into existing curricula, and monitoring of progress in the development of courses and programmes.

3.8.3 Development of a Training Programme in SPIDER.

The development of a training programme, designed to address the perceived limitations in PINs, is necessary to complement the technology transfer which is taking place. It will require an appropriate level of funding and technical co-operation between the developing and developed countries of the Pacific region.

The SPIDER training programme must include close co-operation between the major regional agencies dealing with spatial information, (principally SPC, SPREP and SOPAC). The training programmes currently implemented by SOPAC and as proposed by SPREP/UNEP/GRID are appropriate models, for the type of training that can address the needs of the developing countries of the Pacific.

The programme will need sufficient funds to support :

- in-country courses - administration, activities, equipment, teaching material, curriculum development and staff (either a standing team or on sub-contract basis);
- external courses - administration, staff/participant travel and subsistence, venues, activities, equipment, teaching material, curriculum development, staff;
- fellowships - provision for attendance at courses, workshops and seminars provided elsewhere, coverage of costs for travel and subsistence; provision for study tours or placements in appropriate agencies to learn and/or practice "on the job" skills; cover costs for travel and subsistence and perhaps salary subsidies;
- scholarships - provision for attendance of selected persons at tertiary level institutions for medium (3-9 months) diploma and 3-4 year degree courses (fees, living costs and allowances).

3.9 Follow-up

While systems are operating in organisations the user requirements will change overtime. Systems will have to be evaluated and adjusted from time to time. As part of the network maintenance, SPIDER staff must follow-up and evaluate systems periodically. If necessary adjustments can be made using the services available via the SPIDER network.

4 PROJECT IDENTIFICATION

4.1 Introduction.

In this chapter two projects are identified.

- A project to implement the SPIDER programme at regional level within SPC, to serve the region's needs, to establish some GIS/RS capabilities and co-ordinate information.

- A separate project to provide SPC with some GIS/RS capabilities to support SPC work programmes.

The first project is a long term commitment to install a service facility for the region. The budget for a first phase of 5 years is estimated at approximately 2 000 000 ECU. If the South Pacific Conference decides to provide this service to its members through SPC, the project will have to be elaborated to financial and technical dossiers for submission to donor agencies. In that case it might take up to 2 years before the project would start and , as an element in the project, the SPC office would be provided with the necessary GIS/RS capabilities.

The second project could be elaborated independently by SPC on the basis of this report. Its budget is estimated at approximately 300.000 ECU. This project might be proposed for funding through channels which are faster than for large projects.

If both projects can be realised in the near future, some economies of scale can be realised by saving on SPC's training requirements.

4.2 Project name: South Pacific Information Development and Exchange of Resources (SPIDER).

4.2.1 Objectives

The overall objective of the project is to establish an information network and/or strengthen existing spatial data handling networks, and to create a focal point in this network, located at SPC. Using the network, the project will advise on and promote the effective use of spatial digital data.

To realize these objectives, the following tasks have to be performed :

- establish strong contacts with all national and regional/international bodies dealing with spatial data.

- establish a meta-database, cataloguing information about geo-information and include existing meta-databases or catalogues (e.g. from the RRSP on remotely sensed data, Claasen, 1990). To perform clearing house function for countries, regional organisations and donor agencies.

- disseminate information through the network by a newsletter, stimulating communications between users.

- establish an advisory service for the users of the region at the conceptual and technical level.

- establish standards for data capture and data exchange.

- coordinate and support training activities within the scope of the project.

4.2.2 Major Elements

The major elements of these tasks are:-

- *Regional network establishment*

  This must be initiated at a very early stage of the project by visiting all people involved in geo-information and briefing them on the objectives of the project. They will have to agree upon acting as network nodes.

  The project will on request play the role of catalyst, marketing project demand with agencies best suited to do the job.

- *Meta database maintenance*

  The project will be responsible for establishing and up dating the meta-database. This will also strengthen SPIDER's role as a focal point.

  Hopefully jointly with SPREP, the project will also develop an electronic atlas of the region as a small database of aggregated data (administrative boundaries, major vegetation classes, coastal lines and reefs, terrain mapping units *etc.*).

  Dissemination of information will be one of the important tasks of the project. This would be assisted by the creation of a newsletter. SPIDER will also have to encourage and co-ordinate data and expertise exchange.

- *Support service - Diagnosis*

  To help people with "trouble shooting" and with major computer (software/hardware) breakdown. A diagnosis service will be implemented by the project from the early stage of its creation, connecting the user with a suitable supplier.

- *Advisory Service*

  The project will provide impartial advice on request at the managerial and operational level, to support geo-information and RS projects from the drafting proposal stage to the accomplishment phase.

- *Regional Committee for standards*

  To be set up in the first year, involving country representatives at the managerial level, and the Technical Advisory Committee. This Committee for Standards will rule on data capture and data acquisition format and data exchange protocols.

- *Training Service*

  The project will encourage and support training at all levels from managerial to technical. It will organise and/or assist in the organisation of workshops and short courses and identify funds for training, fellowships and scholarships.

- *SPC Information Co-ordination*

  The project will act from the earliest stage as a geo-digital information co-coordinator within SPC, defining means and strategy to develop info/data circulation and exchange between programmes.

  SPIDER will also provide some PC base hard and software to the SPC office for the use by all SPC's programmes.

4.2.3 Strategy

Institutional Linkages

SPC/SPREP - Since both SPIDER and SPREP/GRID projects will be complementary for resource atlases and inventory projects, it is strongly recommended that SPIDER and SPREP work jointly within a common strategy (see Section 3).

SPC/ESCAP - Since the RRSP of ESCAP ended in 1990, it is proposed that SPIDER approaches ESCAP/RSP for SPIDER to assumes the role of focal point for the existing RS network. It will thus strengthen and expand this network as part of its own spatial data handling activity.

SPC/ORSTOM - ORSTOM strongly wishes to transfer technology to the region. At the same time, SPC's programmes often wish to make use of ORSTOM's capabilities. SPIDER should initiate and co-ordinate training projects and develop joint activities with ORSTOM where possible.

Special Links - Through its network, the SPIDER project would establish very close linkages with one or two key persons in the national and regional agencies which are the most involved in the field of geo-information, to become SPIDER nodes and contribute to the network. Special links should also be established with donor agencies in the region, to prevent project duplication and overlaps.

SPIDER would also maintain close links with both its Technical Advisory Committee (TAC) and the Committee for Standards (CS).

Operational Framework of SPIDER within SPC

- The SPIDER project will be established as an SPC project, directly responsible to SPC's principal officers.
- SPIDER will provide services internally to SPC programmes, with free access to the GIS/RS equipment.
- SPIDER will provide service externally, to SPC member countries on request; including free access to the meta-database, access to information via a newsletter, advisory and diagnosis services, and training for users and students.
- SPIDER will review work implemented, through the TAC, on a yearly basis and will discuss new technological development regarding RS/GIS.

SPIDER should continue the initiatives from the GRID project when it ends, if these are not followed up by SPREP.

4.2.4 Work Programme

PHASE I

In the first year of implementation, the following tasks should accomplished:

Network

The first aim will be to establish operational links with existing networks. Thus the project should position itself as the focal point of the overall network of spatial data users.

Special activities to be undertaken :

- to establish a regional Committee for data acquisition and data capture Standards;
- to establish operational links between the divers SPC's programmes;

- to create special links with regional agencies, suppliers and donors (see chapter II);
- to create or strengthen links with local departments or institutions and choose suitable persons as nodes in these local institutions and departments;
- To initiate the creation of a meta-database and circulate a newsletter to keep the network informed.

Support Service

- To support users with diagnosis and trouble shooting and direct them to the suitable supplier when a major break-is identified.
- To choose a panel of technical advisors and submit it to the Conference as the SPIDER Technical Advisory Committee.
- To make GIS/RS equipment available , for free access, to the SPC's programmes.
- To organise its annual review meeting, inviting diffusers of information (PIMRIS, PAIS, SPREP, TAC and the Committee for Standards) and SPC' programmes.

PHASE II

From the second year of implementation, the SPIDER project will undertake the following tasks.

- To strengthen and expand its network
- To organise a technical workshop with other information diffusers (see above).
- To coordinate user demands and supplier services.
- To coordinate donor agencies programmes, to avoid overlap and duplication.
- To support and coordinate training and fellowship/scholarship function.
- To implement its advisory service.
- To coordinate SPC's internal information circulation.
- To support the SPREP/GRID/UNITAR programme.

PHASE III

Since the UNEP/GRID/UNITAR training project is supposed to end after two years, it is recommended that the SPIDER project maintains continuity in the training programme, if it is not assumed by SPREP.

The project will also have to :

- Support SPREP in its regional database maintenance, if needed;
- Maintain all services implemented in phase II;
- Implement relevant small projects, on request, for small countries, which have no potential for growing towards digital techniques and no possibility of funding for their project.

PHASE IV

In the fifth year, a major review of performance of the SPIDER project will have to be done and presented to its annual meeting, where all parts involved in the network (including donors) should be present. They will state on the achievements of the project and its usefulness. Thus, statement report and recommendations will be presented to the Conference for consideration.

4.2.5 Inputs

Personnel

1 Project Manager, 1 Technical Specialist & 1 Secretary

The Project Manager must be a senior officer skilled in GIS and database management with RS capabilities. In addition, (s)he must have considerable experience in collecting, processing and disseminating information. (S)He will report directly to the SPC's Director of Programmes or the Deputy Director of Programmes.

The Technical Specialist must be trained and skilled in GIS and RS techniques, and computer use (hardware and software). (S)He must also have considerable experience in building and designing databases. (S)He will report to the Project Manager.

The SPIDER project will also contract short term consultants to fulfil specific tasks which are outside the scope of the Project Manager and the technical specialist. These consultancies will be defined when needed as the Work Programme is implemented.

Programme Reviews

The SPIDER project shall be reviewed and advised on a yearly basis by the Technical Advisory Committee (TAC) before the South Pacific Conference. Provision must be made for travel and DSA for participating advisors.

Meeting of Collaborators

SPIDER should initiate and co-ordinate meetings with the Committee for Standards, and with other regional bodies as needed. Provision must be made for travel and DSA of each representative.

Workshops and Seminars

Many Workshops and Seminars for management training will be co-coordinated and/or implemented by SPIDER alone or jointly with other regional/international institutions. Those Workshops and Seminars will be decided by SPIDER and depend on demand and need. SPIDER will have to provide funds for travel, DSA and equipment (when needed) for each participant and educators.

Additionally, the project shall participate in relevant workshops and seminars in the region or outside when considered important. Provision for travel and DSA must be made.

Training courses, fellowships and scholarships

Training is central to the proposal and funds provided must be adequate. Special funds will be allocated to SPIDER on yearly basis to be able to respond to increasing demand for fellowships and scholarship. Funds must be identified for the coming year to avoid any delay after approval by the donor. Provision is needed to cover sub-contracts for trainers and their expenses (including equipment shipment).

Equipment & Supplies

Hardware includes two PC computers (including high resolution color monitors) and peripherals; one very high resolution, large-screen, colour monitor dedicated to image processing (with suitable video card); one tape driver/recorder 1600 BPI; one high quality scanner colour A3 format; one colour printer (ink-jet or thermal transfer) and a colour pen plotter of A1 format.

Software:- Multiscope, MicroBRIAN (for image processing); and EPPL7, IDRISI, Terrasoft PC ARC/INFO (for GIS databases).

These equipment specifications are given as an example of the type of hard/software which is required. The final choice will depend on options available at the start of the project.

Expendable equipment will include documentation, air-photos and some satellite images, tapes (for storage) and computer/peripheral consumables. Other expendable basic equipment needs are office supplies, periodicals, maps, *etc.*

4.2.6 Provisional Estimate of Cost for Project

	Duration (years)	Cost ECU
Personnel:		
Project Manager (P4/5 UN grade)	5	400 000
Technical Specialist (P3/4 UN grade)	5	280 000
Consultancies (all together)	5	250 000
Secretary/Admin Officer	5	100 000
Project Implementation:		
Business travel	5	125 000
Meetings	5	300 000
Training	3 months/year	800 000
Publications	5	50 000
Operations (office)	5	250 000
Annual Review	5	250 000
Equipment, hands on training	5	200 000
TOTAL	**ECU**	**2,285 000**

4.3 Project Name: Provision of GIS/RS capabilities & support to SPC Work-Programmes

4.3.1 Objective

To provide SPC's headquarters with equipment and training to use GI-techniques to support programme work.

4.3.2 Major Elements

- Two GIS systems and one image processing system, all PC-based for general access by all programmes.

- Three workshops of approximately two weeks each to provide training in the concepts of geo-informatics and 'hands on training' on GIS and Image processing systems .

4.3.3 Strategy

The project must complement the ongoing developments at SPC. As IDRISI has been made available to SPREP it would be logical to use 2 more IDRISI software packages or very similar ones (EPPL7, ILWIS).

These packages provide all GIS facility required for spatial analysis and mapping and have direct links to database programmes. They also provide Image processing facilities, though only on image sub-sets of the size of the screen.

Tapes with digital images cannot be read directly and have to be preprocessed by other special image processing software. As this software is nowadays available on PC systems the mission proposes to obtain the 'Multiscope' software which can do all the required (pre)-processing for efficient use in the GI software.

The image processing software and one of the GI software can share the same machine. A second machine should be dedicated to the GI software.

Three workshops must be organised to train staff (including management) in the principles of geo-information handling, image processing and provide hands-on training on the systems.

The first workshop of approximately 1 week could be given on a short term focussing basic concepts of GIS /RS and increase interest in the use GIS/RS through a case study with software already available in SPREP (IDRISI).

A second workshop should be given as soon as the required equipment and software is available. Here the hands-on training will be central and the use in the programmes will be further elaborated.

A third workshop should be given approximately 6 months after the second one to evaluate progress and difficulties encountered in the application of the techniques for project work.

In the event that the SPIDER programme is in operation at the time of the third workshop this could be implemented by SPIDER staff.

4.3.4 Organisation

The GIS and image processing hard and software should be managed by the computer department for use by project staff.

An agreement should be made with ORSTOM for support on request in handling or interpreting images.

4.3.5 Work-plan

January-February 91: presentation of proposal to CRGA.

If CRGA approves:-

March 91:	Elaboration of project proposal for possible donors.
April 91:	Presentation of project to donor agencies.
June-July 91 (if possible):	First workshop for staff and management

4.3.6 Estimated Budget

	Item	ECU Cost
a.	Hardware:	155.000
•	personal computers & peripherals (2) (highest specification possible needed to handle graphical data)	
•	tape drive and/or CD-ROM (1)	
•	colour vector output (plotter) (1)	
•	colour raster output (ink-jet/laser) (1)	
•	digitizers (2)	
•	Large-format, High resolution monitors (2)	
•	High resolution graphic cards (2)	
b.	Software:	
•	Multiscope	30.000
•	IDRISI and EPPL7 or ILWIS	1-10.000
c.	1st Workshop	25.000
•	2 consultants one week	
•	materials	
d.	2nd workshop	45.000
•	2 consultants 2 weeks	
•	materials	
e.	3rd workshop	35.000
•	2 consultants 2 weeks	
•	materials	
f.	Maintenance	10.000
TOTAL		**ECU 301.000-310.000**

5. CONCLUSIONS

Accurate and up to date spatial data in a usable form is a prerequisite for successful resource management in the region.

Since traditional techniques for spatial data collection and processing are too time consuming for pending resource management tasks, the use of modern techniques (RS and GIS techniques) is absolutely necessary to provide the required amount and quality of spatial data in a cost-effective manner. Pacific Island Countries are increasingly using these techniques but are encountering problems which can only be solved with external support.

Major problems include:- getting access to existing data sets, identifying the most adequate suppliers of support services, the lack of trained personnel and a general lack of awareness of the benefits of modern techniques, at managerial levels.

There is a risk that projects for this technology transfer in the region will overlap. Donor agencies want to prevent these overlaps.

The region already has some local networks of spatial data users and a regional programme to support countries in their spatial data handling is required. SPC, as the broadest regional organisation, should provide a clearing house function for problem holders, problem solvers and donor agencies.

A strong network with a focal point at SPC head office, in which a meta-database is maintained, would be the required infrastructure to realise such a programme. The major elements of the programme should be to:-

- revitalize and expand the local networks;
- implement a focal point with a meta-database and clearing house function;
- provide problem diagnosis services;
- provide advice and financial consultant support for nodal project elaboration and implementation;
- provide support for training and fellowships and scholarships; and
- coordinate the establishment of regional standards for data capture, processing and exchange.

In addition, several SPC programmes require immediate access to digital GIS/RS capabilities to enhance their effectiveness. SPC's capabilities in these techniques are underdeveloped and need to be improved.

An information and automation plan for the future would help SPC managers to increase the efficiency of programmes.

6. RECOMMENDATIONS

To the South Pacific Conference, CRGA and SPC managers:

- To endorse the need for a regional programme to support member countries with sufficient high-quality spatial information, through the application of modern spatial digital data handling techniques;
- To implement this programme through SPC and establish a focal point for a network at SPC head office, Noumea;
- To have this proposal elaborated for presentation to funding agencies.

To SPC managers:

- To participate in the meeting organized by AIDAB/ESCAP in March 1991, with a proposal to house and implement the SPIDER programme;
- To invite a member of this mission to assist in the meeting and enable the mission and to incorporate the findings of the meeting in the final report of this mission;
- To contact ESCAP with a proposal to revitalise the RRSP - Pacific sub-programme within the SPIDER programme;
- To contact SPREP with a proposal to extend the SPIDER services to SPREP, to complement the SPREP/GRID programme and prevent duplication;
- To contact ORSTOM (Nouméa) to establish a Memorandum of Understanding providing access to spatial data and processing support for SPC member countries and SPC programme staff;
- To increase SPC's internal GIS/RS capabilities in the short term;
- To strengthen the data linkages between the programmes at SPC through regular technical staff meetings;
- To develop an information and automation plan for the next 5 years;
- To develop an "Electronic Atlas" of the South Pacific region within SPC, in conjunction with SPREP.

To SPC programmes:

- To increase their awareness of and competence in GIS/RS through training of existing staff and through additional selection criteria for new staff;
- To intensify data linkages with other programmes to prevent duplication of effort and mistakes;

To the EC:

- To participate to the AIDAB/ESCAP meeting, in Suva, March 1991 and support SPC in presenting the SPIDER project proposal.

To donor agencies:

- To support the proposal for the implementation of the SPIDER programme;
- To collaborate closely through the SPIDER network on new projects in the area;
- To endorse the need for SPC to increase its GIS/RS capabilities.

The mission further recommends that a copy of this draft report be distributed to all institutions of which personnel has been visited and interviewed during this mission.

ACKNOWLEDGEMENTS

The mission wishes to acknowledge with gratitude the following persons for their help and time during the course of the present consultancy:

- Dr. Daniel van CLAASEN, who kindly acted as a real part of the team, although his responsibilities were principally to ACIAR;

- Mr. Garry PRESTON (SPC Senior Inshore Fisheries Scientist) and Mr. Siliga KOFE (SPC Economist) for their commitment and administrative support in organising the consultancy, briefing the mission, and presenting the team to SPC's programme and management officers;

- Mr. Atanraoi BAITEKE (SPC Secretary General), Mme Hélène COURTE (SPC Director of Programmes), and Mr. V. Poloma KOMITI (SPC Deputy Director of Programmes) for their time spent in briefing us on SPC as an organisation, and the historical developments that led to the present mission.

- Mr. Allan MARCH (SPC Executive Assistant), for his time and his pertinent remarks and advice.

We would also like to thank SPC's administration, which made our regional trip possible and eased our work at SPC. Special appreciation is due to Miss Vive VURUYA, who kindly typed the first draft of the present report.

The mission thanks all SPC's programme officers who were interviewed, for their clear statements and valuable information. The mission is also grateful to all persons visited in the region (see Annex 1) for their interest in the subject, the time spent responding to our questions, and their welcome attitude.

Finally, particular thanks are given to ORSTOM and SPT, who hosted the mission in Noumea and French Polynesia during the 'Pix-Iles 90' RS Workshop.

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Tortell, P. (1982). A report on the feasibility of compiling an environmental atlas of the South pacific. Commission Environment, New Zealand (typed ms, SPREP).

Wilson, S., S. **Hill** and D. **Dale** (1986). UNESCO programme for the management of science and technology for development in the Pacific. Final report of review mission, Aug-Sept. 1985.

ANNEX I: Persons visited by the Mission

In the course of the mission, the team visited number of agencies/institutions. Their names and addresses are listed, with the name and position of the specific person interviewed.

South Pacific Commission

Mr. A. Baiteke,	Secretary General
Mrs. H. Courte,	Director of Programmes
Mr. P. Komiti,	Deputy Director of Programmes
Garry Preston,	Senior Inshore Fisheries Scientist
Jean-Paul Gaudechoux,	Fisheries Information Officer
Tony Lewis	Chief Fisheries Scientist
Jeffrey Stander	Computer System manager
Peter Williams,	Statistician
John Hampton,	Senior Scientist
Peter Thomas,	Environment Programme Officer
Steve Terell-Perica,	Epidemiologist
Elise Kamisan,	Data Processing Officer
Sundat Balkaran,	Demographer
Louise Aitsi,	Women's Development Officer
Rosemary Cassidy,	Librarian
Ellen Watters,	Assistant Librarian/Cataloguer
Carole Martin-Cocher,	Computer Manager
Brian Doyle,	Statistician
Caroline Nalo,	Publications Officer
Seumanutafa M. Hazelman	Tropical Agriculturalist
Peter Walton,	Info Officer/Librarian
Siliga Kofe,	Economist
Mr. A. March,	Executive Assistant

National GIS/RS users

Fiji:

Ministry of Lands and Resources

Mr Cerewale,	Deputy Director of Land and Survey Dept.
Mr Albert Queet,	Director General, Land and Survey Dept.
Pita Tuiloma,	Assistant Director Mapping and Lands, Information Services
Alfred Simpson,	Deputy Director of the Mineral Resources Dept.,

Ministry of Primary Industries

Mr N. Buresova,	Deputy Permanent Secretary
Dr Tim Adams	Acting Director of Fisheries

Native Land Trust Board

Mr Mojeta Mua,	Manager Information System
Tevita Wara	Land Database Administrator

Tonga:

Ministry of Lands, Survey and Natural Resources

Saimone P. Helon,	Geologist

Cook Islands:

Oliver Peyroux,	Chief Surveyor, Department of Survey

Vanuatu:

Jean Tranut,	Deputy Director Department of Land and Survey

Papua New Guinea:

Mr Poka Vagi,	Chief Photogrammetrist, National Mapping Bureau
Mlle C.S.Munagun,	Forest Officer, RS Branch, Department of Forests

Solomon Islands:

Mr Nabura Teka'ai,	Surveyor General, Ministry of Agriculture and Lands

Regional institutional RS/GIS users

Fiji:

University of the South Pacific

Mr Rajesh Chandra	Pro Vice-Chancellor
Mr Randolf Thaman,	Head of Geography
Lionel Gibson,	Lecturer in Geography
Esther Williams,	Librarian
John Morrison,	Head of School of Pure and Applied Sciences
Hugh Williamson,	Ocean Resource Management Project
Robin South,	Professor of Marine Studies

Potential National Suppliers of RS/GIS services

New Zealand

Department of Survey and Land Information

Bill Robertson,	Director General, Surveyor General
Graeme Croker,	Assistant Surveyor General (Data Applications)
Clive Soloman	Director Cartography

Department of Scientific and Industrial Research Physical Sciences

Stella Bellis,	Geologist
David Parman	Image Processor

Department of Scientific and Industrial Research Land Resources

David M. Leslie	Science Group Manager
Peter F.J. Newsome	Head of GIS Service
Bruce Trangmar	Head of Land Evaluation Service (GIS specialist)

Department of Scientific and Industrial Research Land Resources Catchment Management

Garth O. Eyles	Head of Service
Peter Stephens	RS Applications

Department of Scientific and Industrial Research Land Information Support Group

Neil Pullar	Project Manager

Australia

Australian Key Centre in Land Information Studies (AKLIS)

Mr Gregory Hill	Director
Ms Gail Kelly,	Specialist Adviser in RS

Australian Surveying and Land Information Group (AUSLIG)

Grahame Lindsay,	General Manager
David Hobson,	Manager Policy and Co-ordinator
Kevin Wellspring,	Manager
Drew Clarke,	Business Development Manager
Dennis P. Puniard,	Director Operations,

Australian Centre for Remote Sensing

Brian Durbidge,	Senior Surveyor, GIS service

CSIRO Division of Tropical Crops and Pastures

John McAlpine,	Principal Research Scientist Land Resource Management

Mapping and Monitoring Technology

Debbie Kuchler,	Managing Director

French Polynesia

Station Polynesienne de Teledetection
Lionel Loubersac, Director

France

Groupement pour le Developpement de la Télédetection Aerospatiale (GDTA)
J.P. Paris, Deputy Administrator

Potential Regional Suppliers of RS/GIS services

South Pacific Applied Geosciences Commission (SOPAC)
Jim Eade, Deputy Director
Yann Morel, Data Manager
Russel Howorth, Training Co-ordinator
Esther Creek, Librarian

Forum Secretariat
Dirk Blink, Head of Pacific ACP/EC Unit

SPOT Imaging Services
Jean-Louis De Fanti, Chief Executive Officer New Caledonia

ORSTOM
Jean-Francois Dupon, Pacific region Representative
Jean Fages, Director
Willie Bour, Head of RS Department

ANNEX II : SPATIAL DATA AVAILABLE ON PICs

The following list of data is not exhaustive, but corresponds to information gather in visited countries and people met. All air-photos and satellite images covering the Pacific region are reported in the catalogue edited by the RRSP in 1990 (Claasen 1990). This catalogue and others from CSIRO, Australian air- survey and DSIR are being sent to SPC.

Fiji:

- Sets of air-photos covering all Viti Levu, Vanua Levu and some minor islands. All Land use coverage : 1958,1968, 1978, 1986 (colour). Black & white copies available at the Land & Survey Dept.
- Derived products:
  - Land use maps at 1:150000 scale, total coverage
  - Soil classification maps at 1:150000 scale, total coverage
  - Geological maps, all major islands and most Lau Group and Yasawas at 1:100000 scale

Papua New Guinea:

- Sets of air-photos from 1945 to 80's
- Full Landsat MSS coverage in hard copy form and some on CCT, shot during the 70's
- Derived products:
  - Full soil classification maps at 1:100000 scale (all in digital form, PNGRIS)
  - Full land use coverage maps at 1:100000 scale, all in digital form, PNGRIS)
  - Full coverage for forestry inventory at 1:100000 scale (in digital form, PNGRIS Phase II, to be in process)

Western Samoa

- Complete set of air-photos (no date communicated)
- Complete coverage of land masses on digital form, mainly at 1:20000 scale. Stored in IDRISI GIS file format, copy with SPREP-Noumea:
  - current land use
  - soil classification
  - topographic base with coast lines, drainage, roads, nomenclature and selected contours (cadastral boundaries, land capability units).

Guam

- Complete sets of air-photos regularly covered until 80's.
- Some sets of copies are used by the University of Guam, but most data are still with the US Navy-Army.

Tonga

- Complete sets of air-photos of Tonga Islands from 1945 to 1986 (colour) and a SPOT image XS of Tongatapu, 1986 at the Ministry of lands, Survey and Natural Resources

Solomon Islands

- Complete sets of Guadalcanal from 1945 to 1986 (colour) and some sets of Bougainville at the Dept. of Natural Resources.

New Zealand

- Complete coverage on air-photos re-surveyed on regular basis of: Cook Islands, mainly Southern Islands, Niue, Western Samoa, Tonga, Solomon Islands, Fiji.

Australia

- Complete coverage of PNG as air-photos from 1945 to 80's and as Landsat MSS images. Some Landsat TM are also stored in CSIRO.
- Some coverage of Fiji as air-photos and Landsat MSS (NW Viti Levu).
- A SPOT image XS mode, 1986 with University of Victoria

French Polynesia
(stored at SPT) :

- Full coverage of all islands by SPOT in XS mode and some in Panchromatic mode from 1986 until 1990
- Some SPOT images XS mode of other Pacific islands also available : Fiji, Tonga, Cooks ...

ANNEX III : TERMS OF REFERENCE

A team of selected specialists will carry out a study to examine the feasibility of establishing a geographical information service facility within the work programme of the South Pacific Commission. The broad intention of the study is to determine means of improving the availability of geographic information to, and utilisation by, the SPC work programme, and beyond that, the regional users whose activities the Commission supports, The scope of the study will encompass all forms of geographic information, including maps, atlases, resource inventories, aerial photographs, digital images (including their analysis), etc.

The study team will consist of three selected external specialists and one SPC resource person, and will take place during a six-week period in 1990. Approximately 3 weeks will be spent at SPC headquarters in Noumea, New Caledonia, the remainder of the time in consultative visits to relevant establishments in New Caledonia, French Polynesia, Australia, New Zealand, and other selected regional locations.

Specific aims of the study will be as follows:

1. Examine the uses of geographic information within the SPC work programme, and define areas where technological or procedural improvements could benefit existing activities. Specifically:

- hold discussions with the staff of the Fisheries, Environment, Agriculture, Demography, Rural Technology and other programmes in order to identify the resource survey, mapping, evaluation and monitoring goals of the different components of the work programme;
- describe current practices and procedures in the use of geographical information;
- identify means of improving these practices and procedures, in both qualitative and quantitative terms.

2. Examine the geographic information requirements, and the facilities available for meeting them, at national and international levels in the Pacific Islands region. specifically, investigate and describe:

- the differing needs of countries and agencies for terrestrial and aquatic resource survey, mapping, evaluation, and on-going monitoring;
- the need for support to such activities, including provisions of technical services, training, education and research;
- the capacity of existing national and international establishments to meet these needs.

3. Investigate options for the establishment of a geographic information service facility within SPC that will contribute to the needs of the SPC work programme and of the Commission's member countries. In particular:

- recommend the best option given the requirements of the SPC work programme, costs, quantitative and qualitative benefits, and the potential role of the facility in respect to regional requirements;

- provide a broad strategy for implementation of the recommended option, including timing, training requirements, and operational arrangements.

4. Provide a comprehensive report, documenting the findings of the study for consideration by the SPC Committee of Representatives of Governments and Administrations.

On all matters pertaining to the study, the team will be responsible to, and will receive direction exclusively from, the Secretary General of the South Pacific Commission or his appointed delegate.

ANNEX IV : AGENDA OF THE MISSION DURING THE STUDY

The mission was implemented following the itinerary below.

12 November 1990	Beginning of mission at SPC headquarters.
12-19.11.90	meeting with SPC's programmes based in headquarter.
19-21.11.90	finish to meet all SPC's programmes and attend Pix-Iles Conference in Noumea.
21-23.11.90	attend second part of Pix-Iles in Papeete and have meeting with all country representatives and service suppliers.
24.11.90	depart Papeete.
25.11.90	evening reach Auckland.
27.11.90	Christchurch, meetings with DSIR.
28.11.90	Wellington, meetings with DOSLI.
29.11.90	Palmerston, meetings with DSIR.
30.11.90	Palmerston North, meetings with DSIR (soil conservation).
1.12.90	reach Auckland via surface.
2.12.90	depart for Nadi.
2.12.90	arrive in Suva.
3.12.90	meetings with SPC's plant conservation and USP library and Marine resource training programme.
4.12.90	meetings with SOPAC management and AKCLIS training director.
5.12.90	meetings with IMR, SOPAC and USP' geography Dept. and Ministry of Land & Survey.
6.12.90	meetings with Ministry of Primary Industry and Dept. of land & survey mapping Dept.. Reach Nadi by surface.
7.12.90	depart Nadi for Brisbane, meeting Tropical Crop & Food CSIRO Dept.
11.12.90	Depart Brisbane for Canberra and start work on report in Canberra.
12.12.90	meetings with university's Tropical Studies Dept.
13.12.90	meetings with AUSLIG.
14.12.90	work on report.
15.12.90	reach Sydney by surface and depart for Nouméa.
16-27.12.90	review SPC's programmes and write draft report.