Highlights

- **Launch of New remote Sensing Satellites**
- **Country News Vanuatu & Marshall Islands**
- **Software Development**

Highlights

- **GIS Application: Backdrop, Projection**
- **Remote Sensing Technique**
- **Application of High Resolution Images**

Pacific Island GIS/RS *news*

The Newsletter of the GIS/Remote Sensing Users in the Pacific
Issue 00/03

More Interest in Remote Sensing and GIS than ever before ......

SOPAC's 29th annual session was held in Tarawa, Kiribati from 26th September to 04th October. All member countries expressed highest interest in all parts of GIS and Remote Sensing development and will enhance their application. Small Island States such as FSM, Nauru and Marshall Islands will start to establish their GIS system, which is partly reflected already by this newsletter. The Pacific Island Countries supported the enhanced co-operation between USP and SOPAC in the fields of GIS and Remote Sensing. After recent talks, this will also include the University of New Caledonia. In addition, the countries expressed the need for high-resolution satellite image backdrop to replace outdated maps. The Pacific Island Countries welcomed the European Union Project, which will - after the project approval - install and enhance GIS/RS units in all Pacific ACP countries.

After announcing the upcoming launch of QuickBird during SOPAC's annual session, the launch was a disaster for EarthWatch the company, which developed and owned this satellite. This is the second satellite the company has lost, however, since the launch was covered obviously well by insurance EarthWatch will be able to launch QuickBird 2 , soon. OrbImage the company responsible for OrbView-3, which is another satellite carrying a high-resolution image sensor, did not release news about its launch, but a press release is expected very soon. IKONOS will record the first high-resolution image data for a South Pacific Island country with SOPAC having ordered images for Tongatapu, Tonga. During the process of the data order, the company Space Imagine did review its policy. The minimum data purchase increased from USD 2000 to USD 6000 due to the fact that there will be very limited multiple selling of the image data when switching on the sensor images before and after because the requested coverage will only show water, not of interest to other customers. Nevertheless, the data purchase is on its way and SOPAC in image acquisition experience will benefit all Pacific Island Countries.

This newsletter reports several GIS and RS techniques, which will be of interest for many GIS operators in the pacific. The use of different projections, spheroids and datums is a problem in many Pacific Island Countries. One article explains in detail how to handle this when using MapInfo. The use of GIS backdrop increased steadily after starting such application for the power utility in Tonga. One technical article summarises the production and application of GIS backdrop. Another technical contribution describes the utilisation of historical aerial photographs for change detection, which will become of interest when inexpensive high-resolution satellite image data is available. Integration of different software is explained by the example of TEPB GIS. Finally, the ongoing open GIS/RS software development is reflected by this newsletter. SOPAC is part of FMaps, which will fill the gap of application software running under Linux. This will provide free GIS and RS software for all Pacific Island Countries.

This newsletter provides country overviews for Marshall Islands and Vanuatu. Contributions from Cook Islands, PNG, Samoa and other did not reach SOPAC in time. These articles we can look forward to in the next issue of this newsletter.

Wolf

Download your digital version from SOPAC's web site ..!

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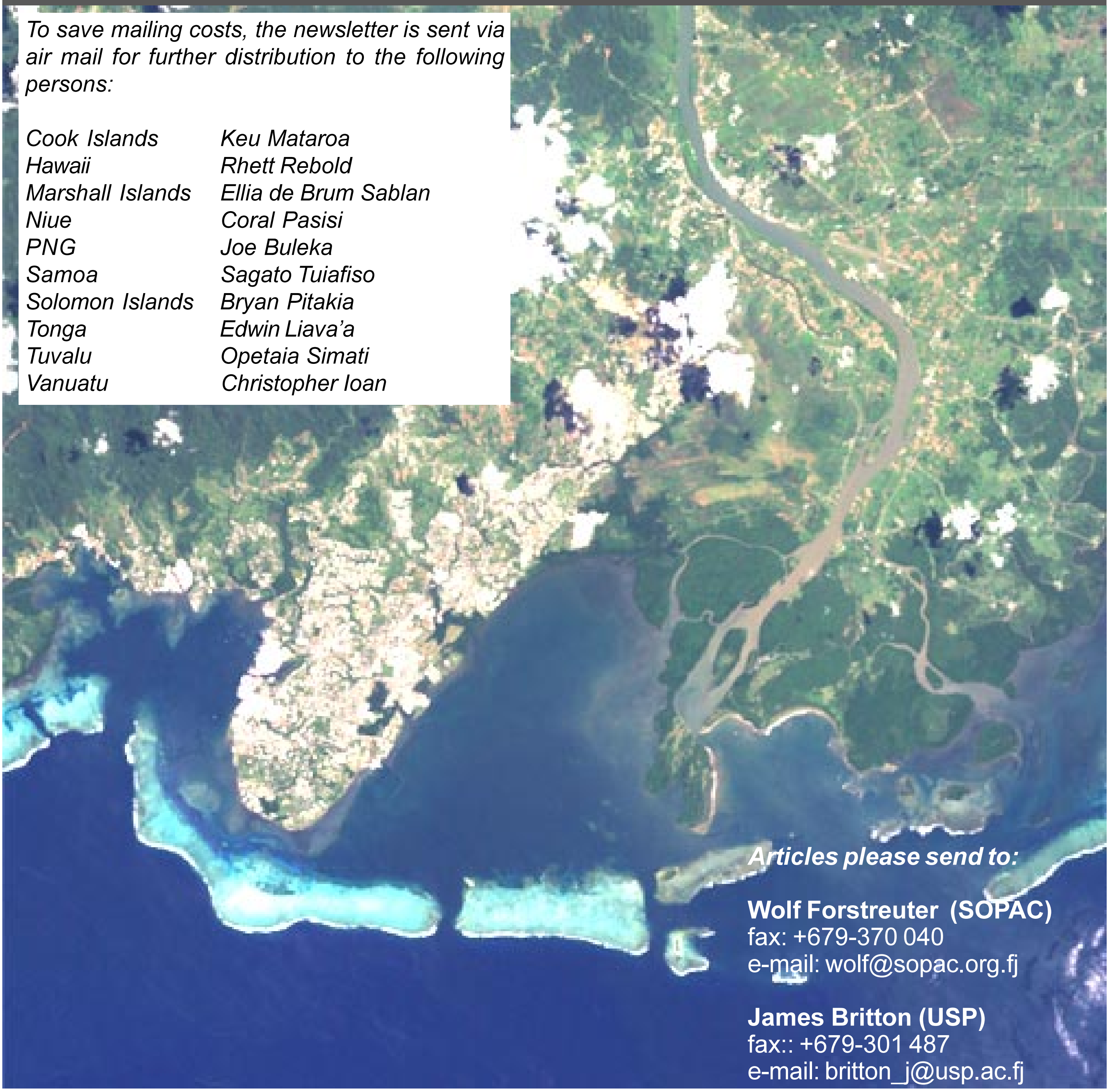
Suva Subset of Landsat TM Scene purchased by USP & SOPAC



To save mailing costs, the newsletter is sent via air mail for further distribution to the following persons:

Cook Islands	*Keu Mataroa*
Hawaii	*Rhett Rebold*
Marshall Islands	*Ellia de Brum Sablan*
Niue	*Coral Pasisi*
PNG	*Joe Buleka*
Samoa	*Sagato Tuiafiso*
Solomon Islands	*Bryan Pitakia*
Tonga	*Edwin Liava'a*
Tuvalu	*Opetaia Simati*
Vanuatu	*Christopher Ioan*

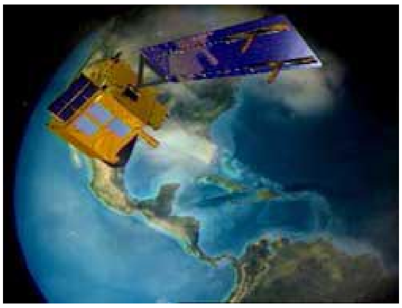
Articles please send to:

Wolf Forstreuter (SOPAC)
fax: +679-370 040
e-mail: wolf@sopac.org.fj

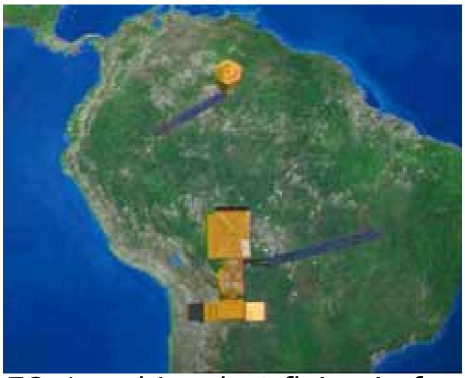
James Britton (USP)
fax:: +679-301 487
e-mail: britton_j@usp.ac.fj

EO-1 in Space !

First released from the rocket launched on 21 November was NASA's Earth Observing-1, a technology demonstration craft. The mission seeks to prove the utility of advanced Earth-imaging instruments that could be employed by the next generation of Landsatype remote sensing craft. EO-1 carries a suite of two imaging instruments along with a device that will remove the distorting effects of the atmosphere. The purpose of the missions is to test the capabilities of risky new technologies in orbit to ensure they work before incorporating them into real science satellites. To check EO-1's imaging eyes, the craft will rendezvous with the Landsat 7 satellite currently orbiting the Earth in about three weeks. EO-1 will fly one minute behind Landsat 7, snapping pictures of the same swaths of the planet's surface so scientists can directly compare the images. The craft's sophisticated camera system uses one-fourth the power and has one-fourth the mass and weight of the counterpart imager on Landsat 7. It is also 40 percent cheaper and should be able to resolve finer details in its pictures that are currently just noise in Landsat data. A smaller instrument requires smaller spacecraft and they in turn require a smaller launch vehicle and the smaller mission can be built on a smaller schedule. In addition to the imagers and atmospheric corrector, there are five other advanced technologies aboard and enhanced formation flying software that will allow the craft to control itself in order to keep within three kilometers of Landsat 7.



An illustration of the EO-1 spacecraft observing Earth. Photo: NASA-GSFC



EO-1 and Landsat flying in formation. Photo: NASA-GSFC

QuickBird did not Make it!
Copied from Stephen Clark,
SPACEFLIGHT NOW

A commericial U.S. eye-in-the-sky satellite launched by a Russian Cosmos rocket on Monday 20.11.00 failed to reach orbit according to news reports from Moscow and U.S. tracking data. The QuickBird 1 craft lifted off at about 2300 GMT on Monday aboard a Russian Cosmos-3M rocket from Plesetsk Cosmodrome, but signals from the satellite were not picked up as planned by ground stations. The $60 million satellite was to be operated by Colordao-based EarthWatch Inc. U.S. tracking data reported the satellite's initial orbit as approximately 78x610 kilometres and lists the orbit as now "decayed". The Interfax news agency has quoted a Russian Aerospace Agency spokesman as saying that QuickBird 1 was "effectively lost." Reports said the second stage of the Cosmos-3M shutdown too early. The failure of the QuickBird 1 launch is a major blow to EarthWatch, which lost its first satellite EarlyBird 1 four days after its December 24, 1997 launch due to a problem with its power system. EarthWatch is developing a network of satellites to image regions of the Earth for a variety of commercial applications, including environmental monitoring, land management, mapping, agriscience studies, and disaster monitoring. QuickBird 1 was planned to orbit in a circular perch 590 kilometres high, inclinated 66 degrees to either side of the equator. This inclination allows unique imaging times. From orbit, QuickBird 1 was to collect both one-meter resolution digital black-and-white imagery and four-meter resolution digital colour images. These high-resolution images were to be taken by the QuickBird instrument, a high-resolution camera, during orbital daytime. Digital images taken from orbit will rival aerial photography in terms of both cost and possible economic and scientific applications. The spacecraft was manufactured by Ball Aerospace and Technologies, Corp., of Boulder, Colorado. Ball provides launch integration and on-orbit commissioning of QuickBird 1 from the time QuickBird 1 arrived at Plesetsk at the end of October.

Artist's concept of QuickBird 1. Photo: EarthWatch

For more details see: **http://www.sopac.org.fj/Projects/GISRS/RSNews/index.html**

GIS and Remote Sensing Activities in Tonga

Robert Smith
SOPAC

The National Oceanic and Atmospheric Administration (NOAA) uses IKONOS satellite imagery to map, measure and, potentially, monitor U.S. shallow-water coral reef ecosystems in the Caribbean and the Pacific Rim. The IKONOS remote sensing satellite was launched in September 1999 and provides NOAA with a new technology to understand the coral reef habitat. Dr. Steve Rohmann, a physical scientist for NOAA, and colleagues have nearly completed coral reef mapping activities in the U.S. Caribbean and are initiating similar activities in Hawaii, especially the north-west Hawaiian Islands. Rohmann's project includes the use of IKONOS one-meter resolution panchromatic and four-meter resolution multispectral imagery to evaluate and map these areas. NOAA research has shown that IKONOS imagery has been found to have a depth penetration of up to 30 meters in clear water. Rohmann stated that the IKONOS satellite can be pointed to minimise sun glint over water and maximise sunlight penetration and bottom feature visibility.

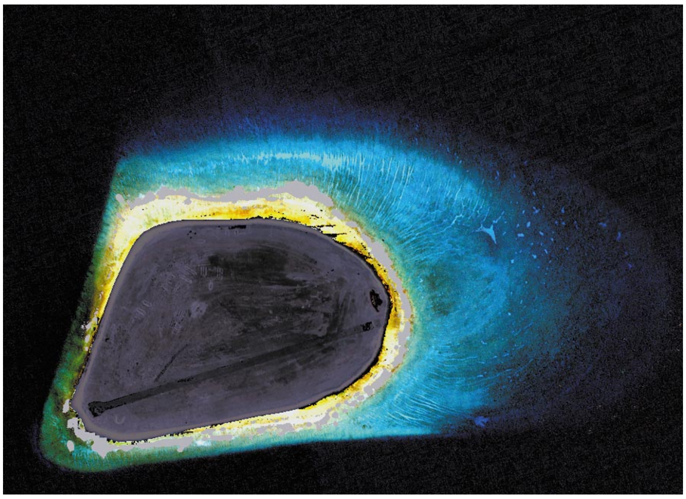


Figure 1: *This four-meter IKONOS image of Baker Island, located approximately 1,650 miles south-west of Honolulu, Hawaii, is being used by the National Oceanic and Atmospheric Administration (NOAA) to monitor the coral reef ecosystem surrounding the island. Baker Island is about 1.6 square kilometres in size. Credit: spaceimaging.com*

Here in the South Pacific, SOPAC for the first time will use IKONOS to assess coastal erosion problems for Tongatapu and Atata islands in the

Figure 2: *Atata shore line*

Figure 3: *Inundation threating coastal village in Hihifo*

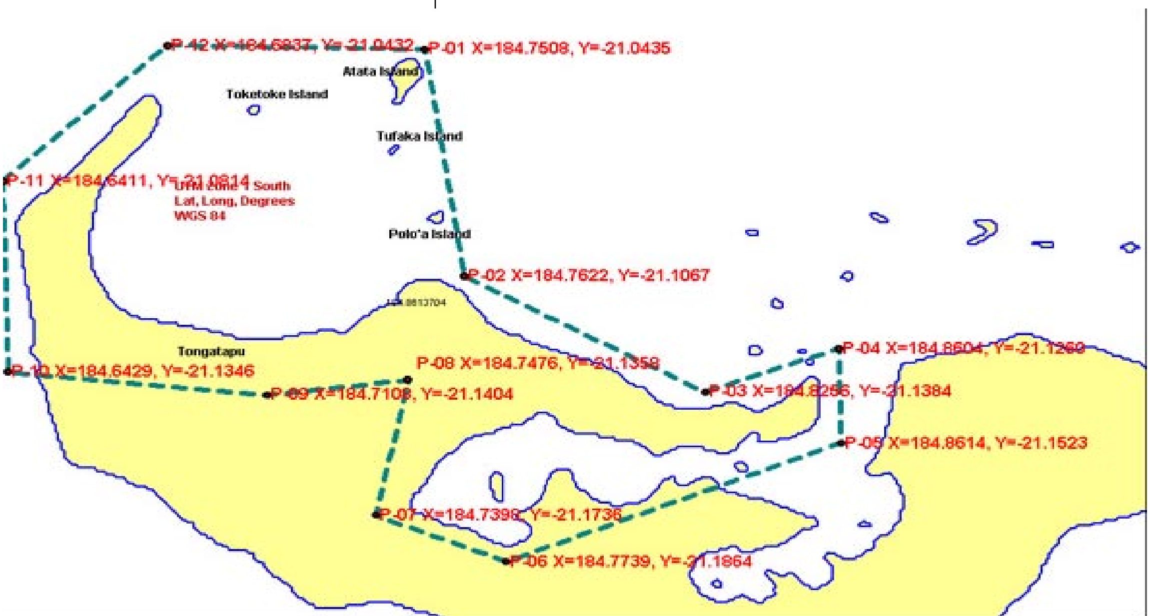


Figure 4: *IKONOS data is ordered for the area within the dotted green line. The minimum purchase order is USD 6,000 equivalent to 176 hectare.*

Tongan group of islands. Inundation loss of coastal vegetation, and mangroves are apparent in recent site photos taken for Hihifo (see Figure 3) and Atata (see Figure 2) shoreline suggesting there are a number of factors contributing to the problem. Existing aerial photography for the areas in question is only available up to 1990, 10 years on there is an urgent requirement for updated imagery to assess the problem. Examination of photography taken in 1980 (b&w) and 1990 (colour) show both areas of concern to have been very stable during this period. With no imagery taken during the 90's and the acquisition of updated photography for image analysis for what could be considered as two small remote areas to mobilise an aerial survey was not seen as an option in terms of logistics and cost. Both sites also incorporate an extensive fringing reef platform and lagoon. With IKONOS, however, SOPAC saw an opportunity to use new technology to assess the problem from onshore through the coastal zone and into the reef-lagoon system. In the context of small island management the ability to be able to monitor island and surrounding coral reef ecosystems through the use of high resolution multispectral imagery is seen as an affordable mapping and monitoring tool that will be of great benefit to the remote Pacific Islands.

Inexpensive Land Cover Change Detection for Pacific Island Countries

Wolf Forstreuter
SOPAC

Introduction

In many Pacific Islands Countries change in land cover is readily apparent but seldom quantified due to lack of historical satellite data and/or high cost of analysis of aerial photography. However, new image analysis software allows converting historical aerial photographs to geometrically corrected spatial data layers that can then be compared over time. A quantitative analysis of change that has taken place between sets of aerial photographs recorded at different times becomes feasible. The change detection images in this report were prepared while assisting a USP student undertaking a geography project.

Data Correction and Data Input

SOPAC's A3 scanner was used at 600 dpi to retain optimal resolution for aerial photo sets from Suva peninsula from 1973, 1986 and 1994. More than 20 ground control points were used for each aerial photograph to rubbersheet the central projection to Fiji Map Grid. Then, the images were stitched together to create a one layer each for the three different years.

Figure 1: *The change detection image of Suva peninsula: Aerial photographs recorded in 1973, 1986 and 1994 have been scanned, geometrically corrected and combined to one colour image as described in the text and by Figure 2.*

The Change Detection Image

ERDAS software was used to compare different layers and several options are available:

1. different displayed layers can be geolinked that moves the cursor correspondingly in both windows and allows easy visual interpretation
2. different layers can be combined to a synthetic image as shown in Figure 1 that highlights changes in different time periods in different colours.

The second approach will be explained in further detail as this method could be applied to other areas that highlight coastal erosion or vegetation cover loss especially in Pacific Island Countries where low cost historical aerial photographs are available.

Normally, a colour image consists of three black & white layers linked to the video monitor three colours of red, green and blue (RGB). However, normally all three layers are recorded at the same time (for example a SPOT image). Here, images recorded at different times are each geometrically referenced and mosaiced and then imported into one three layer image as shown in Figure 2. All parts reflected white in the 1994 image will be shown red if the corresponding image parts are dark in the 1986 and 1973 images. Parts only shown white in the 1986 image will be shown green and parts only white in the 1973 image layer will appear blue in the change detection image. If features are white in all three image lay-

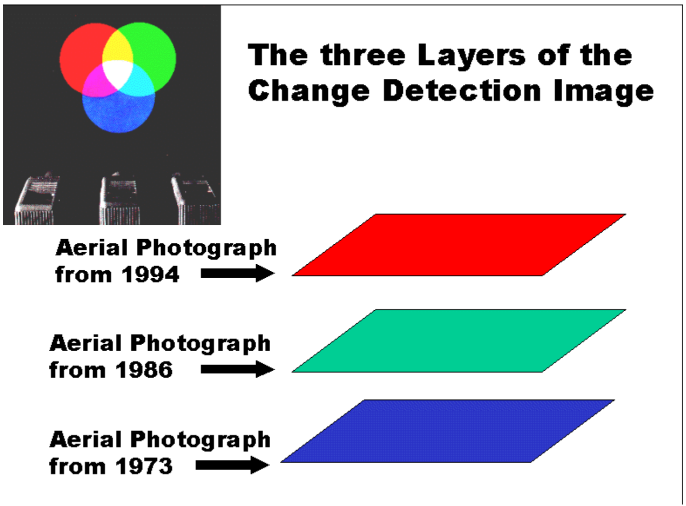
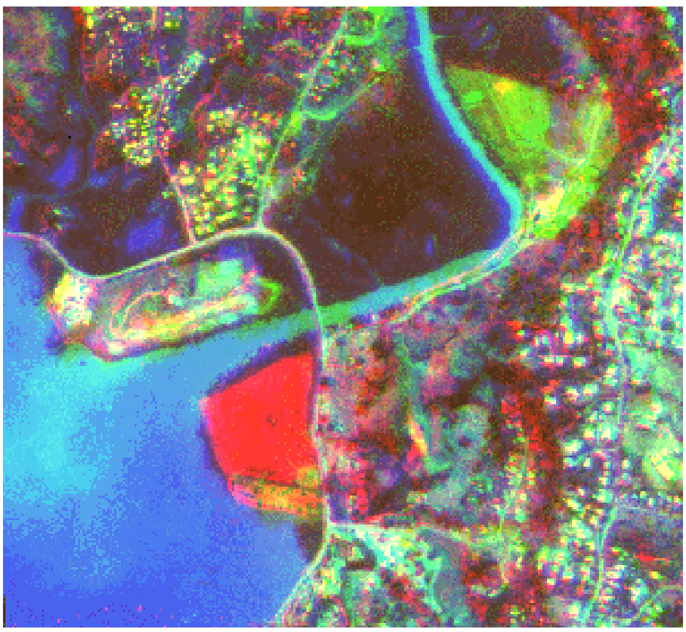


Figure 2: *By combining the geographical corrected digital black & white images to one three layer RGB image, the colours acting additive.*

ers they will appear white, if features are shown dark in all three layers they will also appear dark in the change detection image and if features are white in two of three image layers they will appear in the additive mixed colour of the two corresponding layers.

Most changes in urban or nearby areas result in vegetation loss. Vegetation creates absorption of sunlight, which results in dark tone in the aerial photograph. After clearing the vegetation, houses are constructed or the soil stays without any vegetation for some time. This creates high reflection with resulting light tones in the aerial photograph. At a later stage, trees will regenerate around houses and the corresponding image area will again have a darker tone. This change of dark tone to light tone and then back again to a darker tone can be documented when recording images from the same area in time sequences of several years. Naturally, not all images are suitable as clouds, cloud shadow, hot spots can influence the image illumination in a way that the image colours do not reflect the land cover. It is therefore essential to exclude these areas of the image.

Figure 3: *The aerial photographs employed for the change detection image in the time squence: Ar eas recently cleared appear in light tone in the corresponding photographs. The corresponding colour then appears in the change detection image, compare with Figure 4.*



Results

The change detection image is an ideal tool for visual interpretation of change of land cover. If an interpreter would compare separate aerial photographs visually, small areas of change will most likely be overlooked. The change detection image highlights all changes and the interpreter will concentrate on the interpretation of changes rather than their identification. Furthermore, the image is geographically referenced drawing a polygon around the area of change automatically provides the quantitative figure in hectares. The change detection image is a product which can be provided as image backdrop to different government departments, such as hous-

Figure 4: *(left) Subset of the change detection image: In the centre red indicates the container area cleaned from mangroves between 1986 and 1994. Green indicates clearings and settlements established during 1973 and 1986. See also Figure 3.*

Figure 5: Another subset of the change detection image covering the Suva area: The developments within the two different time periods are clearly visible. The big claim of area happed between 1986 and 1994 most parts of the industrial area was established between 1973 and 1986 and partly contiued during the period 1986 and 1994.

ing and development, environment planning, forestry, agriculture, etc.

Visual interpretation is still recommended, because water can have different illumination due to different sun angle or different flight direction as shown in the tone of the river in Figure 3. However, if aerial photographs are available with similar illumination, semi automatic image analysis procedures can provide quantitative change data if such change detection images are employed.

Conclusion and Recommendations

Using scanner and image analysis software the described method allows an accurate, easy and inexpensive way of change detection. Once the change detection layer is prepared as image backdrop it can be easily analysed by interpreters of socio economic, environmental or forestry background by using simple GIS tools.

The application of change detection images is important to document and analyse urban changes. Many historical aerial photographs are available for Pacific Island Countries and it is recommended to use these photographs.

Even more important would be the application of the described technique to document and analyse coastal change. It would allow documenting the link between coastal erosion and human influence such as destruction of mangroves, construction of flood gates, sea walls or river-course change.

To highlight recent changes new aerial photographs could be recorded, however, this is extremely expensive in Pacific Island Countries. IKONOS data from space would provide a more economic solution with an even better resolution (1m in panchromatic mode, the scanned aerial photographs have a resolution of 3m) and the scanning and stitching process would be avoided in addition.

For further information regarding the technical questions contact wolf@sopac.org. For further question regarding changes in the Suva area contact: Jessica Stabile stabilejc@aol.com

GIS-PacNet

If you want to receive e-mails keeping you in the picture about:

- **latest development of satellite image data available for Pacific Island Countries,**
- **latest news of software for GIS, Remote Sensing and GPS,**
- **jobs available in GIS, RS and GPS related fields,**

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This list is also helpful if you have a question related to hardware, software, data analysis in GIS, RS and GPS related subjects. You ask and someone will have the answer, because he already came across this problem.

Just e-mail to:

wolf@sopac.org

or

britton_j@usp.ac.fj

We put you on the list!

GIS Establishment and Training in Marshall Islands

Ellia de Brum Sablan

For some years now, the Marshall Islands Government has been keen on educating and training its people and establishing GIS/RS in the country. Slowly the Government's wish is becoming a reality.

Since early this year, the RMI Government, RMI/USP Extension Centre and AusAID have been working and collaborating together to firstly, develop a user group mainly from the key sectors that would benefit the most from the establishment and training of GIS/RS. The group will be awarded with five scholarships to commence GIS studies.

In February 2000, a total of six students, two from the Land & Survey Division, one from the Marshall Islands Water & Sewer Company, one from the Marshall Islands Electric Company, and two college students were given scholarships to do a certificate in GIS studies at the RMI/USP Extension Centre. The group is completed their first two courses. (see Figure 1). By January next year 2001, the Government and RMI/USP Extension Center expects an additional of four new students making a total of 10 students in the GIS Certificate program

Figure 1: *Top left to right: Melba White, Tommy Keju, Ermina Bing*
Bottom from left to right: Labb Capelle, Jasen Langidrik, Bill Labaja

The second phase of the planning will be to conduct an in-country on-the-job training in GIS/RS and then eventually set up GIS/RS systems in key government agencies. The Marshall Islands has solicited technical assistance from SOPAC to help in the establishment of the GIS hardware and software and also to conduct the training. In addition to the students, other government employees will take part in the training. The government agencies expected to benefit from the program are Coastal Management Division in Environmental Protection Authority (EPA), Lands and Survey, Public Works, Planning and Statistics, Historical Preservation Office, Disaster Office, Marshall Islands Marine Resources Authority and the utility companies.

The expected output of this GIS program is firstly, the Marshall Islands will have people educated in GIS. The education component will help the country develop a broad base of needs and also enables it to deal with realities of the future; Secondly, practical training component will help the country meet its immediate and specific needs and its demand now; and Lastly, government agencies will receive equipment, both hardware and software that is essential in carrying out the country's work.

We would like to take this opportunity to thank the RMI/USP Extension Centre, Dr. Irene Taafaki, the Government of Australia, Mrs. Dana Russo, and SOPAC for their help and support for GIS program in the Marshall Islands.

Remote Sensing for mangrove mapping in Fiji

Samuela Lagataki, Forestry Department, Fiji

In many tropical coastal countries, mangrove ecosystem is amongst the most important natural resource, especially in many of the Pacific Islands. But, the usual lack of information about this resource is the main reason for the lack of realization of its importance. Mangrove ecosystems protects our shorelines from excessive coastal erosion, provides food for coastal and small island communities, habitats and breeding grounds for certain terrestrial and marine organisms, and birds, building materials for houses, fuel-wood, and the list goes on and on. Yet, they are a threatened ecosystem in most parts of the world and Fiji is no exception.

Figure 1: *Landsat TM image of mangroves in the Rewa Delta, east of Suva, bands 1, 2, 3.*

The total area of Fiji's mangrove forests had been variously reported by different authors. Richmond and Ackerman reported a total area of 49,777 ha in 1975, Saenger et al (1983) reported a total area of 19,700 ha, Watling (1985) reported a total area of 38,543 ha, and 42,464 ha by the Forestry Department during the 1991 Fiji National Forest Inventory (NFI).

This is a clear indication that Fiji needs another survey of its mangrove resource to re-define it and to re-confirm its true area, extent of coverage and distribution.

More than 90 % of all mangroves occurring in Fiji are within the coastal areas of Viti Levu and Vanua Levu. Studies carried out by Watling (1985) shows that there is a real threat for the Fijian mangrove communities within these two islands. The threats are due to the following human activities.
based on digital data, manipulation, re-classification, and re-calculations could be done very quickly if certain parameters such as infrastructure, development sites, etc. changes.

Applied analysis of remotely sensed data and GIS is now done by local staff at the following institutions in Fiji, MSD-Forestry, SOPAC, MRD and ALTA. With the existence of the GIS user forum for Fiji and the South Pacific, raster and vector GIS now taught at the University of the South Pacific and the recent cooperation between institutions in Fiji to co-purchase satellite scenes, the future of raster and vector GIS for Fiji is gathering momentum and certainly is getting brighter.

Given the importance of our mangrove ecosystem, the threat it currently faces, and the pressing need for more land for the purpose of agriculture, urban and rural development. Resource managers must set a balance between development and conservation. Technology such as remote sensing and GIS is ideal for such purpose. Due to the availability of technology and local expertise, the potential of GIS and remotely sensing for mangrove management in Fiji and the Pacific could be enormous. We have the potential and the ability, the GIS user community had come so far, this will be another challenge and a step forward towards the use of GIS and remote sensing for the management and planning of mangrove resources within Pacific island countries.

FMaps

Franck Marin, SOPAC

Creating an OpenSource GIS/RS for GNU/Linux on Gnome

GNU/Linux is an OpenSource operating system that could benefit Pacific Island Countries (PICs). It is robust and free. It is developped in a collaborative manner over the Internet by many people and companies. Each one contributes freely to the development of such operating system. It is a good news for PICs as they are not obliged to invest in software when you know that software represents more than 70% of the cost of computing. It is moreover true when copyright laws are fully applied.

Figure 1: *FMaps at http://fmaps.sourceforge.net*

GNU/Linux however lacks a user friendly GIS/RS software. There are some software providing such tasks like GMT, GRASS,... But they are not really user friendly, like MapInfo or Arcview. The purpose of FMaps is to create a user friendly OpenSource GIS.

The benefit, will be that all can participate to the development, empowering Pacific Islanders and ensuring that needed functions are implemented. The system is based on a true client/server database which allows out of the box true multiuser support over the network. It contains a metadata catalogue which is ISO compliant. All operations and objects are fully 3 dimensional objects which allows needed representation possibility for mining, ocean profiling, town planning,...

The benefit for Pacific Islands is tremendous. It will allow replacing costly Microsoft based software with a free alternative. In the domain of computer software that SOPAC and its member countries are using, everything can be replaced by GNU/Linux except in GIS where SOPAC is using MapInfo which has no GNU/Linux equivalent so far. If Island Nationals are stimulated then they can participate in the development of this software, bringing them needed skills at home. It serves 2 purposes: reduce the software budget of Pacific Island Nations, capacity building by empowering Pacific Island Nationals.

What is available right now? If you go on the project site http://fmaps.sourceforge.net/ you can read more about the project, see some screen captures and download the source code. At the moment FMaps is in its alpha stage, not very useful, but it allows to build upon it. I expect to have a beta version, something useful but bugged by beginning of next year. In SOPAC we are planning to put more resources on the project by march next year through a french student sponsored by the French Embassy.

How can you participate? See above to download the source code or to join the developper mailing list. Any contribution is welcomed such as code contribution or documentation contribution, or simply suggesting ideas...

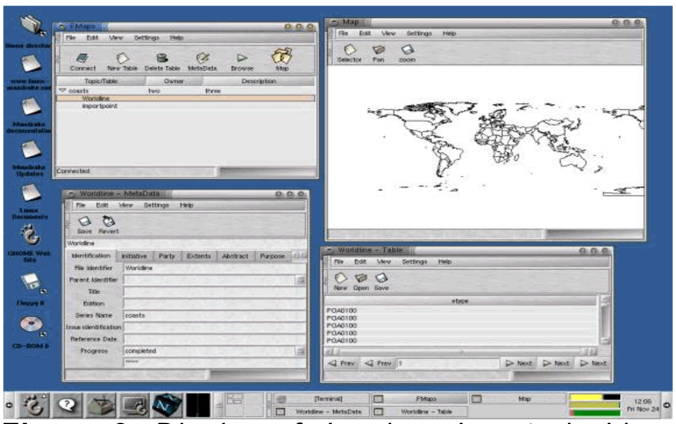


Figure 2: *Display of developed parts in Linux environment*

GIS Backdrop

Wolf Forstreuter, SOPAC

Introduction

During the establishment of GIS environment for the Electrical Tonga Power Board the need for image data in GIS environment was identified. The demand was to have additional information to that already provided by a cadastral map. Other utilities demanded image backdrop as well and today the preparation of GIS backdrop is an important service provided by SOPAC. This article describes the types of image backdrop, their preparation and potential of application.

Types of Image Backdrop

There are different types of image backdrop, but they are all raster images, where every picture element is geographically addressable. The backdrop is geographically referenced to the same projection as the overlaid vector information. The raster images of the image backdrop can be aerial photographs, satellite images or maps in raster data format.

Satellite Images or Aerial Photographs

Satellite images are the classical image backdrop. They are already in raster data format and only need geometric rectification to be imported to GIS. Aerial photographs are used if larger scale than 1:50,000 is required or in cases where no satellite images are available. Since modern software is able to convert the central perspective of aerial photographs into the required map projection, aerial photographs are more frequently used. They also provide historical information from times where no satellite images were recorded. An application will to be investigated by SOPAC: for areas where aerial photographs cannot be corrected due to missing ground control points (GCPs), georeferenced satellite data will be taken as reference during the correction. This will provide another source of high-resolution image backdrop.

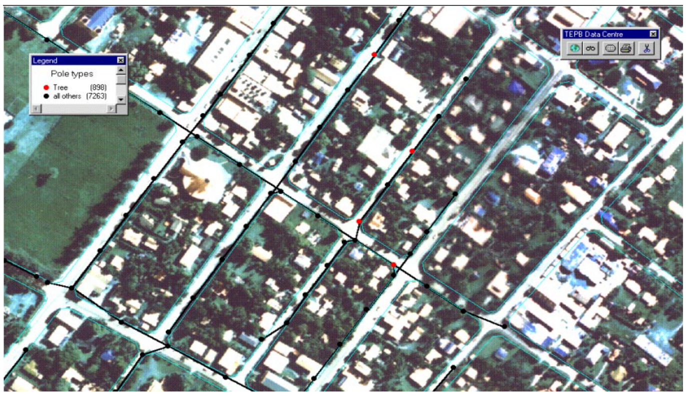


Figure 1: *Image backdrop for Tonga Electrical Power Board in Nuku'alofa. The image is overlaid with the cadastral map and with a layer showing the power poles and low voltage lines. Employing this GIS backdrop the service teams see where vegetation touches power lines and from which side the customers can be connected best. Such information is not provided by a cadastral map.*

Maps

Image backdrop is not limited to aerial photographs and satellite images a physical map can be converted to a raster image and treated as backdrop. For Fiji Islands all available topographic maps of the new 1:50,000 Lands Department series are converted to backdrop files and can be copied from SOPAC, see Figure 3 for an example of a topographic map as image backdrop. Recently a project based at SOPAC converted available nautical charts for most Pacific Island harbours into GIS backdrop. They can be displayed in the ships for navigation or in central GIS for disaster mitigation highlighting areas of risk. Several thematic information such as the forest type / forest function map for Fijiis available as GIS backdrop (see Figures 3 and 4). Others, such as erosion risk map, could be produced easily.

Results of Special Image Enhancement

Ratio images highlighting areas of drought-affected vegetation (available for West of Viti Levu in Fiji), change-detection images (see corresponding article) or image-classification results are available as image backdrop. These backdrops will be used for documentation and planning.

Creating Image Backdrop

To create image backdrop, scanner and image analysis software is required. Satellite images are already in digital format. Maps and aerial photographs have to be scanned. Then the resulting image files have to be geometrically corrected, and the images stitched to one layer and finally they can be imported to the GIS.

Scanning or Data Purchase

Aerial photographs require a scanning process with minimum resolution of 600 DPI otherwise the information content of the photographs is highly reduced. Furthermore, it is important to scan aerial photographs in one go, because it is very time consuming to rectify different parts of an aerial photograph and mosaic them later. Therefore, the scanner should be A3 in size. The scanning of maps only require 200 DPI and again an A3 scanner is important for saving time. The scanning process converts aerial photographs or maps to raster data image files. These have to be georeferenced later.

Geometric Correction

The process of geometric correction links to each picture element (pixel) the x and y co-ordinates of the required map projection. Image analysis software calculates such a transformation formula using GCPs identified in the image and in the corresponding map. A linear transformation is sufficient when correcting images of scanned maps, digital satellite images require a polynomial transformation of second degree; and to transform aerial photographs, a rubbersheet correction is preferable.

Image Stitching

Once all aerial photographs, parts of topographic maps or satellite scenes are geographically referenced, they have to be combined to homogenous layers. This requires two activities from image analysis software: a) to cut the overlapping part b) to smoothen the transition between different images. This requires image analysis software it is impossible to perform these steps with photo editing software such as Photoshop, Photopaint, Photoeditor, etc.

Import to GIS

Modern image analysis software provides output in GeoTIFF and modern GIS software can import such files directly. The current version of MapInfo cannot read such files yet and the import has to be performed by the operator. There are two ways to do this: a) during the import, the image files have to be georeferenced again by using the MapInfo tools for raster image reference, b) the operator creates own *.TAB files referring to the image file. Solution b) is faster and more accurate.

Pyramid Layers

Image backdrop can slow down GIS display on small computers. However, there is a way to overcome such a disadvantage by producing pyramid layers for such backdrop files. MapInfo has the capability to display files in relation to a defined zoom range of the files. Overviews backdrop do not require high resolution and if zooming in where high resolution is necessary the display only needs files covering small parts of the complete area.

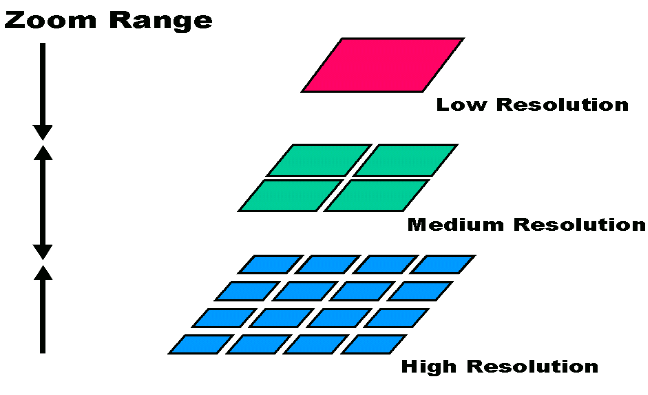


Figure 2: *Pyramid layers of GIS backdrop files allow a fast display. Such a backdrop shows a file of low resolution if an overview is required and selected backdrop files of high resolution if the operator zooms in.*

To create pyramid layers as shown in figure 2 the resolution is reduced from the original image file to create layer 2 and then further reduced to create layer 1. Smaller resolution reduces the file size, which speeds the display and rooming of the layer. Layer 2 is than cut into four files and layer 3 into 16 files. Depending on the zoom factor, layer 1, 2 or 3 is displayed. The display in higher resolution displays only the files required for the area to be viewed.

To create pyramid layers the subsets of the original image file are created by a batch run. Furthermore, a program developed in SOPAC creates all necessary MapInfo TAB files which automates the import to MapInfo GIS.

Application Potential of Image Backdrop

This chapter highlights some applications of GIS backdrop. There are far more applications possible and the provided examples are far away from showing the complete picture, but they allows us to see the potential of GIS backdrop as a tool.

Map Replacement

As said in the introduction, the GIS backdrop production started, because TEPB in Tonga requested additional information to the cadastral map. The display in figure X shows power pools and customers in natural environment. TEPB immediately sees where lines are going through tree branches and which is the best side of a house to connect a customer.

Maps to navigate in shallow water mostly do not exist in Pacific Island Countries. Having the GIS backdrop on the monitor in the boat the current position of the boat can be displayed on top of the backdrop, which makes navigation easy and safe.

Area Analysis

FEA asked SOPAC to estimate the flooded area if a dam securing water for power turbines is extended for 20 and respectively 40 m. Having the topographic map as GIS back-

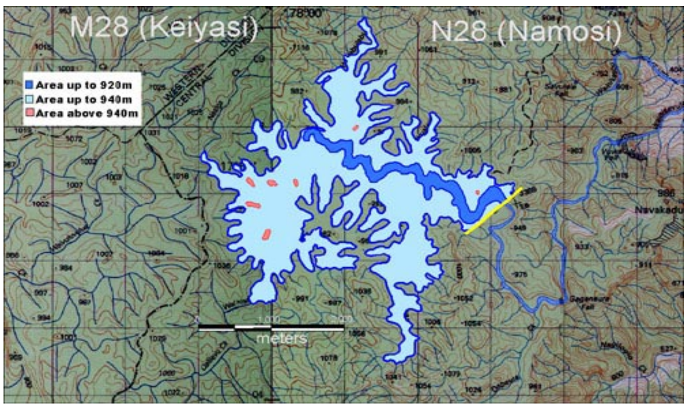


Figure 3: *The topographic map as GIS Backdrop. Digitising the contour lines show the extent of flooding if increasing the dam 10m (blue) or 20m (light blue). The area calculation is then an automatic procedure of MapInfo.*

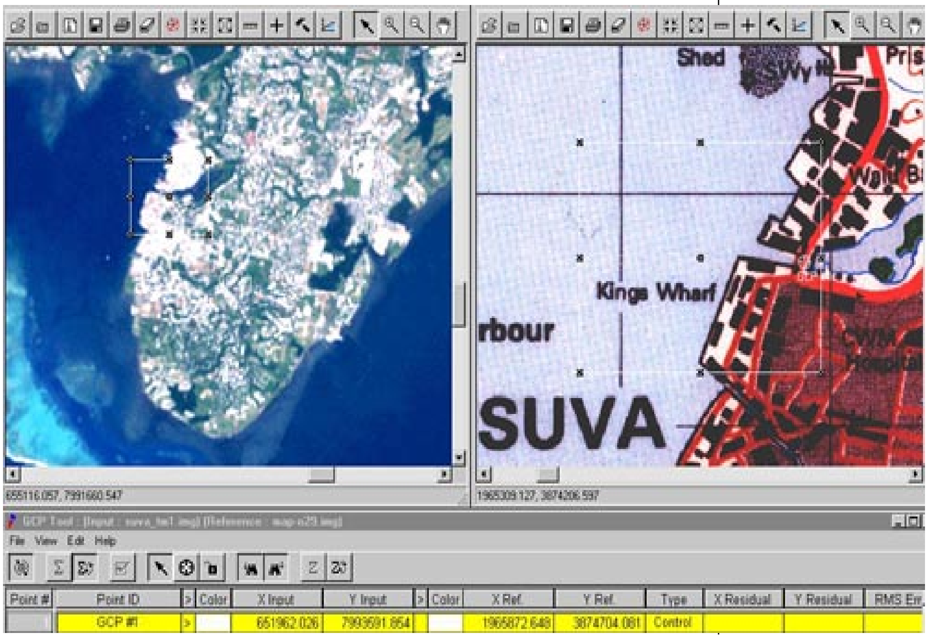


Figure 4: *Using GIS backdrop instead of a map, which is placed on a digitising table, allows the software to indicate the approximate position of the next GCP. This increases the productivity immense.*

drop, it was easy to follow the corresponding contour lines to create polygons indicating the landscape flooded and the parts of landmass looking out of the flooded area. Within one hour it was possible to send back the area figure of the flooded landscape and a digital map which can be printed on any common printer.

Similar application is nearly a daily occurrence in Fiji's Forestry Department, when area calculation has to be carried out. Instead of using planimeters image backdrop can be displayed and a polygon can be drawn, which is more accurate, faster and a map can also be printed out.

Sample Plot Determination

Whenever inventories are carried out it is necessary to calculate the area concerned. In addition, it is essential to display possible plot centres, which are linked to the local Fiji Map Grid (FMG). If mapbackdrop is involved, which always is georeferenced as described above, MapInfo provides an easy tool to display a grid over the defined area. The grid sections show the locations of possible plots and out of these possible plot locations randomly a number of plots will be selected and than established and measured in the field. The relevant part of the backdrop can be printed and taken as map into the field.

Image correction

Image backdrop of topographic maps also speeds up geometric image correction, if backdrop is used as reference instead of a physical map. After three ground control points (GCPs) have been identified, the operator only clicks the GCPs on the image (right side in figure 4) and the system already locates the possible position of the corresponding GCP on the backdrop. The operator only has to adjust the position, which saves a lot of time. In addition, GIS backdrop does not have the distortions caused by change of temperature or change of moisture, which always affect the accuracy when digitising GCPs from a map.

Investigation for Potential areas

If an area is proposed for development, which can be farming, logging, urban development, etc., it is now possible to display different spatial information for this area. For exam-

Figure 5: *An example of GIS backdrop application in Forestry. The area outline e.g. a proposal for forest management under FSC regulations is first digitised using the topographic map backdrop. Then, the polygon is displayed over the satellite GIS backdrop to see if the area is still stocked by forest. Finally, the Forest Type / Forest Function GIS backdrop shows, that the main part is protection forest, which limits the forest management.*

ple an area is proposed for heavy logging, the following steps allow an immediate answer "YES" or "NO" to the issue of a logging license:

1) digitising the area on the screen using a topographic map backdrop,

2) display satellite backdrop to see the forest condition,

3) display the forest type / forest function map and realise that the forest is protected.

Conclusion and Recommendations

The production of image backdrop is fast and the potential for different applications is huge.

Secondly, Landsat 7 TM images are delivered without copyright restrictions. If maps are scanned and converted to GIS backdrop there is also no copyright restriction within the region of Pacific Island Countries.

It is recommended that GIS backdrops to be produced for Pacific Island Countries financed by international donors and that these backdrops be delivered free to the different users in the countries. This would not only develop GIS application in general, but it would also allow the different agencies to have a unique spatial database. Conflicts of interest could be solved and planning would be improved.

For further information contact: wolf@sopac.org

MDO, MapX and TongaEPB GIS

Edwin Liava'a, TEPB

Introduction

Our NCS Billing Counterparts from Napier Computer Systems introduced MDO and MapX to TongaEPB GIS. This was part of the strive towards implementing the GIS on the Intranet. So far a Demo program in VisualBasic 6.0 has been developed to justify that the concept works. But it would be most effective when we have finally established all geographical objects on the GIS platform. These will then be used as the base for Geoset (.GST) layers using Map-X, which will be used in the VisualBasic Project.

What is MDO?

Magiq Data Objects.

Why MDO?

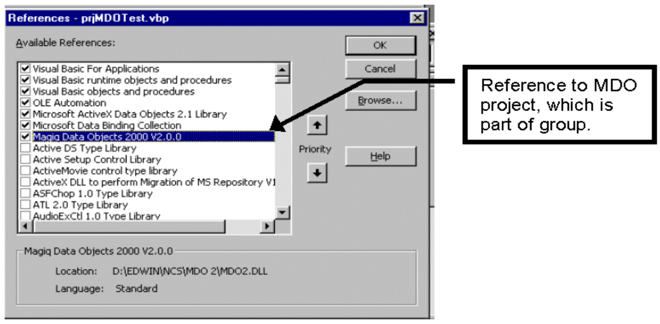
Queries and extraction of data from our NCS UNIX Box are tailored using Hyper Magiq Scripts.

Installing MDO

To use MDO either MDO must be an installed DLL (via a setup program) or a member of the project group (*.vbg), the later being best for debugging.

Using MDO

A reference to MDO is required in the client program, made through **project/references** on the menu.



A MDO connection variable is declared, usually globally.

Private conMDO As New mDO2.mdoConnection

A connection is then opened.

conMDO.OpenCn
"server=central;
uid=t1adm;
program=NCPM00.O;
menuid=.0988"

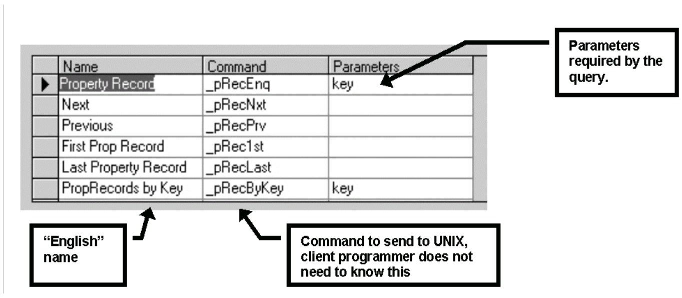
[This has to be one command line, which is difficult to print in the format of the newsletter. The second line represents the Unix host name, the next line the logon name, the following line the Program to run and finally the Menu location of MDO server]

Using the openschema method can retrieve a recordset of available commands.

Set DataGrid1.DataSource = conMDO.OpenSchema(mdSchemaProcedures)

[This has to be one command line]

The example above fills a grid with available commands.



MDO commands

MDO commands are references to host-side procedures/ reports. To use, a variable is declared as type mdo Command.

```
Dim MyCmd As mdoCommand
Dim rst As ADODB.Recordset

    Set MyCmd = MDO![PropRecords by
    Valn]
    MyCmd!Key = “0988040000”
    Set rst = MyCmd.Execute
```

“Set MyCmd = conMDO![PropRecords by Valn]” is short-hand for:

Set MyCmd = conMDO.Commands(“PropRecords by Valn”)
MyCmd is the command called “PropRecords by Valn”, from the connections collection of commands

If a command has one or more parameters these are set using the ‘bang’ symbol.

```
MyCmd!Key = “123”
MyCmd!Date = “11052001
```

Once these are set, the command can be executed to return a recordset result.

```
Set rst = MyCmd.Execute
```

Updating fields

MDO supports the standard recordset update method.

If the user changes values and updates, MDO will automatically package up the new values and send them back.

```
Set cmd = MDO![PropRecords by Valn]
cmd!Key = “0988040000”
Set rst = cmd.Execute
With rst
  ![Property Key] = “12345”
  ![Cert of Title] = “AB/CD”
  .Update
End With
```

Host-side commands

When MDO connects it sends a _commands to the host, which replies with a list of commands.

```
_fields
Name:1:20:A
Command:21:15:A
Parameters:36:150:A
_end
_list
Title Search        _search        key
Refine Search       _refine        key
Undo Search         _undo
Inquiry             _inquiry       lineno
Author Browse       _asearch       key
Subject Browse      _ssearch       key
Series Browse       _usearch       key
Publisher Browse    _psearch       key
Open Borrower       _openborrower  id:pin
Borrower Reserve    _reserve       id:pin
Borrower Reserved   _reserved
Stake start         _ststart
Item category list  _listcats
Locations list      _listlocs
_end
_?
_
```

A command is sent to the Host in the format:

```
         1         2
123456789012345678901234567890
_openborrower 0001;1234
```

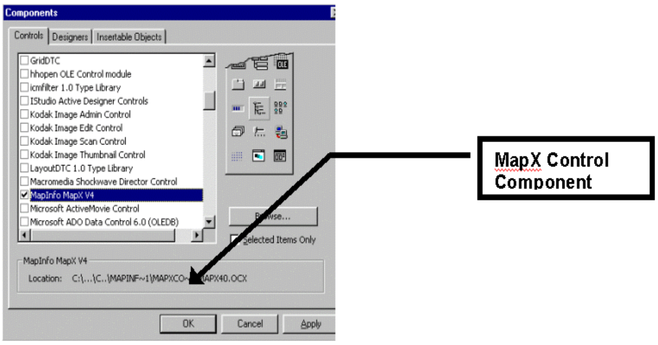
hostname of command

semi-colon delimited list of parameters

MapX

MapInfo MapX is a mapping ActiveX (OCX) control that lets you easily add powerful mapping capabilities to your applications. It is based on the same mapping technology used in other MapInfo products, such as MapInfo Professional and Microsoft Map. If you have created or purchased MapInfo map data (tables) for use with MapInfo Professional or Microsoft Map, you can use those same files with MapX.

MapX is a tool for application developers. It offers the easiest, most cost-effective way to embed mapping functionality into new and existing applications. MapX is an OCX component that can be quickly integrated into client side applications using Visual Basic, PowerBuilder, Delphi, Visual C++ or other object-oriented languages and in Lotus Notes (v4.5) using Lotus Script. Developers can work in the environments they’re familiar with, and end users can access mapping through their familiar business applications.



Adding Map Control on the VisualBasic Toolbox

Creating a Simple Map in a VisualBasic Project

Select Map With MapX, it's easy to add a map to your application. In fact, you can add a working map to a Visual Basic form without writing a single line of code.

1. Select the Map control from the Visual Basic toolbox. (If the Map control does not appear on the toolbox, see Adding the Map Control in this chapter.

2. Draw a box on your form, representing the area where you want the map to appear. MapX displays a preview of your map.

3. Right-click on the Map control, and choose Properties from the shortcut menu. The MapInfo MapX Properties dialog box appears.

4. Locate the Current Tool option, which is near the bottom of the General tab. Set the Current Tool to "1003 - Zoom In" and click OK.

   Run your program to view the map. Notice that whenever the cursor is over the map, it changes to a magnifying glass with a plus sign.

For further information contact:

ittepb@tongatapu.net.to

GIS in Vanuatu

James Britton, USP

Introduction

GIS is alive and well in Vanuatu with over 30 different offices using the Vanuatu Resource Information System (VANRIS) and other GIS projects starting up in Municipal and Telecom areas. Most GIS activity is centered on VANRIS, a MapInfo/MSAccess-based GIS system originally set up to map natural resources across the country. From its original beginnings, VANRIS has adapted with changes in computer technology and increasing demands from its users.

VANRIS: Basic Concepts

The premise of VANRIS is simple. It starts with a base map data layer made up of essentially homogeneous areas of land referred to as Resource Mapping Units (RMUs). Over 5000 RMUs have been mapped out based on similarities in geology, landform, climate, soils, and vegetation. While not a perfect model in that these features are not exactly the same across the space within each RMU, the simplified method of storing geographical information does allow for a workable national level GIS.

Added to this map database is an attribute database giving the data describing each RMU. Data for each RMU includes the above attributes as well as land use, population data, as well as other special characteristics like conservation activity and community resource development projects.

The third component, and perhaps the most important when the popularity of VANRIS is considered, is an easy to use interface that leads the user through the process of spatial query and mapping. Rather than have the user interact with MapInfo at the system level in an *ad hoc* or random manner, VANRIS has a set of user interface screen that present all the possible selections from the data in the attribute database. By working through various menu screens, the user is able to define the map they wish to see. Selections are made from either check boxes or drop-down selection boxes. When the map is finished, pre-made MapInfo tools allow simple customising of the final map through the addition of scale bars, north arrows and modification of legends.

The end result is a system that is easy for a wide range of users. This makes the system more attractive to use and has been a key element in its success. Users with basic or little GIS skill can use the limited option menus to get results. Skilled users can access the VANRIS data through MapInfo without having to use the menu screens. As a result VANRIS is used in many offices including Forestry, Geology, Fisheries, Agriculture, Tourism, Education, Health, Statistics, and Commerce. There is also a range of users in the various provincial and local offices.

Vanris Data

But a simple to use system does not necessarily mean success. To be useful, it must contain good data and the right kind of data that different users need. Users must feel the meets their needs, not the other way around. To make sure this happens, VANRIS functions almost as a community of users with a central coordinating core. That core is currently the Land Use Planning Office (LUPO) within the Department of Lands. Williams Ganileo, Database Manager for VANRIS coordinates a user group made up of all the departments who use VANRIS. Through regular meetings, this group is able to make adjustments to the system and make sure the needs of all users are met.

VANRIS is made up of data acquired from a range of organisations. While most of the data is natural resource oriented, data comes from areas such as education, rural development and health. Each user organisation is responsible for maintaining their own data and they add this data to the common pool with LUPO acting as the coordinator for data updates and distribution. As staff change in different office, so to does the level of support for the VANRIS project. Like in so many other GIS projects in the region, continuity of support and personnel is a major factor in the long-term success of the project.

It is also possible for individual organisations to add their own specialised or more detailed data to the basic data provided by VANRIS. The Geology Department adds information about mining leases and other geological information. In the Department of Forestry, data about logging operations and other forest management practices complement the VANRIS data.

Utilisation of VANRIS

VANIS can almost be considered a community rather than just a system. Like all communities, it depends on the goodwill and efforts of its members and a continual level of effort and support from all involved. By acting as a tool for data sharing and access rather than a “system from above”, VANRIS is able to maintain a high level of user enthusiasm and support. Coordination through the LUPO office is important, but so is the input of the users.

The community aspects and real strengths of VANRIS are appreciated when one considers some of the smaller users of VANRIS. Among these is the Vanuatu office of the Foundation for the Peoples of the South Pacific (FSP). FSP is a local not-for-profit voluntary NGO that focuses on community development through the promotion and support of sustainable development projects. It is a small organisation and does not have a deep base of information technology skills, much less full time GIS experts on staff. The ease of use of VANRIS has allowed FSP project officers to integrate GIS mapping into some of their community level projects. FSP staff indicate that the inclusion of maps and geographic data increase the community interest in their projects and allow them to show the results of their work more widely. Not all projects use VANRIS, but if the project officer feels it is important or just wants to use maps, VANRIS is an accessible and useful tool. Again, VANRIS is not being used for sophisticated spatial analysis, but it is getting geographic data out to the communities and, perhaps more importantly, getting community data into a national level database that is shared with other agencies and users. So a multinational minerals exploration company might wind up accessing local community data from villagers at the same time it accesses “expert” geological data.

Further uses of VANRIS are possible. Currently there is a plan to start mapping important historical and cultural sites. Other possibilities exist. It is simply a matter of an end-user organisation taking the time and effort to coordinate their data collection with the LUPO coordinating manager and other VANRIS users and then make the effort to collect and maintain the data.

Other GIS in Vanuatu

But VANRIS is not the only GIS application in the country. New projects just beginning include the use of GIS to control Malaria by the Health Department and more detailed ecological analysis within the Forestry Department. Telecom Vanuatu Limited has begun a project to implement GIS. Local surveying company, GEOMAP has assisted in the compilation of a GIS-quality survey of the Capital, Port Vila as a pre-cursor to establishing a municipal GIS.

With this base level of GIS operation in place, people are beginning to look at further development. Key GIS users are looking to increase their skills and begin using their systems in more sophisticated ways. During my visits to various GIS offices in Vanuatu in October, most users expressed the desire for more training in order to use the system more effectively and with more confidence.

The Future of VANRIS

Challenges still exist however, for the continued development of GIS in the country. VANRIS was established under Ausaid funding, which has now ended. It remains to be seen whether the government will supply the funding to keep VANRIS going. We can only hope so as Vanuatu has a good base in GIS technology and practice. It would be a shame if this were lost.

The VANRIS model, which has been used in other areas, such as PNG, is one that provides an accessible national level GIS. While the types of geographic analysis are not that “exotic”, the system does provide the basic GIS need for a wide range of users, many of whom have limited GIS skills. The system offers flexibility in that different users can contribute to the database pool and more skilled users can add their own data or processing methods to the basic system. But perhaps more importantly than the system itself is the model of collaboration and continuity that allows a coordinated group of organisations to own their own data, contribute it to a collective pool and all share in the benefits of that information resource. As with many information technologies, the strength of this GIS is the people that keep it going. Without this continued support, even the best technological solution will just fade away into the dust!

Kiribati Local Mapping Data and their Definition in MapInfo

David Llewellyn

Background

During the 60's and 70's the Directorate of Overseas Survey arm of the Ordnance Survey Organisation of Britain (DOS) produced an attractive set of Photomaps of the islands of Kiribati, mostly at a scale of 1:25,000. Even today these maps are still the best and most widely used maps of the outer islands of Kiribati. In order to establish the geographic position (latitudes and longitudes) of the mapping, a local 'Datum' was established on each island.

These local 'Data' ('data' being the plural of 'datum') would originally have consisted of an 'origin' point and another point (a mire) observable from the origin on a known azimuth from true north. Given a known point and a reference point on a known azimuth you can establish more points. The position of the origin point and the mire would have been established at that time by 'Astronomical' observations.

As well as establishing these local data, a 'coordinate system' was determined for each island. A coordinate system consists of a datum, a projection, and values for the required parameters of the chosen projection. The projection chosen for all the coordinate systems and subsequent mapping of Kiribati islands was the **'Transverse Mercator'** projection. The parameters that are required for the 'TM' projection are;

- datum,
- units (metric or imperial),
- longitude of origin or central meridian,
- latitude of origin,
- scale factor at the central meridian,
- false easting,
- false northing.

If you look at the base information on the OS photomaps of each island you will see the names of the local data as well as the TM projection parameters for each coordinate system. The coordinates of survey control points (eastings and northings in meters), established by OS on each island are based on these coordinate systems, and with the exception of Tarawa, are still in use.

Some more recent mapping done by the DOS of the Line and Phoenix groups and Banaba is based on the WGS72 datum. The WGS72 datum and its sucessor the WGS84 datum are global 'geocentric' data; ie their centres coincide with the centre of gravity of the earth and they are applicable world wide.

In 1980 the Australian army, as part of 'Operation ANON', re-observed some of the original data points established by the DOS on the islands of Kiribati. These new observations were made using 'Doppler satellite' techniques. The datum

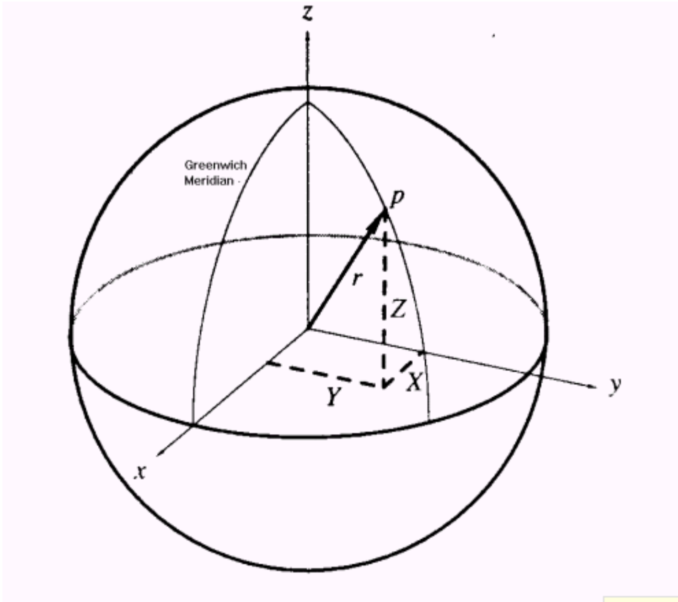


Figure 1: *Cartesian Coordinates*

used at that time for Doppler satellite observations was 'WGS72'. This provided a set of 'common points' whose geographic (or geodetic) position was known both in terms of the respective local data and the WGS72 datum. When you have a point whose position is known in both the local datum and the WGS72 datum then you can calculate a set of 'shift parameters' that relate the two data. You can also relate the local data to the 'WGS84' datum (the successor of WGS72), since there is a standard relationship between WGS72 and WGS84. The standard shift parameters based on one common point are a shift in X, Y, and Z. These 'shift' parameters are basically derived by calculating the 'Cartesian coordinates' of the point based on each datum and then finding the difference between the two sets of cartesian coordinates.

The shift parameters can be calculated using standard geodetic formulae. There are also programs available free over the net that can calculate these shifts. One is called 'Molodensky' available from Mentor Software. AUSLIG's (Australian Survey and Land Information Group) site also has an excel spreadsheet available for download that performs the same calculation.

These 3 parameter data definitions are only as good as the original observations on which they are based, and at best in absolute terms only accurate to around 10 to 20 meters. The fortunate thing for Kiribati, being a nation of small islands, is that small changes in the relative positions of islands don't matter that much; they have no effect on the relative accuracy of surveys carried out within individual islands and the ocean can 'absorb' any anomalies that in a large land masses can occur when 'one datum meets another'.

Defining the Kiribati Custom Mapping Data in MapInfo

Since the local data used in the Kiribati mapping are not widely used or known and are not inlcuded in the pre-defined data that are included in Mapinfo, it is necessary to define them as 'custom data' and include the custom data defintions as part of coordinate system definitions in the Mapinfo projection file (Mapinfow.prj).

An example of a custom coordinate system definition including a custom datum definition for of one of the Kiribati islands is shown below:

"Beru local grid", 2008, 999, 4, 211, -588, -6, 7, 175.9833333, 0, 1.0, 10000, 300000, 0, 140000, 20000, 170000

The elements of this definition are:

"Beru local Grid": A descritive name of the coordinate system

2008 : The number of the Transverse Mercator projection in MapInfo is '8'. If you want to define the 'bounds' of your coordinate system then you add 2000 to the number of the projection; thus 2008 is a coordinate system using TM projection and we also will define the bounds of this coordinate system.

999 : This number is used to indicate to MapInfo that the following 4 numbers in the coordinate system definition represent a custom datum definition.

4 : The number 4 represents the ellipsoid used in the datum definition. In our case 4 is used as this is the number of the 'International 1924' ellipsoid originally used.

211, -588, -6 : These are the X, Y and Z shift parameters calculated as described above. All custom datum definitions in MapInfo must be defined in relation to WGS84, so the shift parameters are always between the local datum and WGS84.

7 : This is the number of the units to be used. In our case we use 7 as this is the number for meters.

175.9833333 : This is the central meridian in decimal degrees. If you look on the OS photomap of Beru you will see that the central meridian (or longitude of origin) is 175º 59' 00".

0 : This is the latitude of origin. In this case the equator or zero degrees.

1.0 : This is the scale factor at the central meridian. Scale changes with distance from the central meridian on a Transverse Mercator projection. In the Universal Transverse Mercator system this scale factor is 0.9996. This minimizes the change of scale over the entire 'zone' of mapping. In our case the islands mapped are of a relatively small east-west extent so it is acceptable to leave this scale factor at 1.

10000, 300000 : These are the false easting and false northing in meters respectively. These are used so that coordinates in meters for the area mapped are always positive.

0, 140000, 20000, 170000 : These are the coordinate system bounds. 0, is the minimum easting; 140000 is the minimum northing; 20000 is the maximum easting and 170000 is the maximum northing. If you look again at the OS photomap of Beru and inspect the coordinate values in meters along the margins of the map you will find that the maximum and minimum values for easting and northing are within these figures. Bounds are used to increase the available precision of the map tables in MapInfo. Using bounds such as those defined for the Kiribati coordinate systems allows positions of map data to be stored to the millimeter level. This is important to preserve Survey accuracy of points stored in the MapInfo tables.

Tarawa Mapping Data and Coordinate Sytems

On Tarawa the situation is a little different. This is the custom coordinate system definition for 'Tarawa Local Grid (Secor Astro 1966)':

"Tarawa local grid (Secor Astro 1966)", 2008, 9999, 4, 259.418, -31.724, -3.795, -1.381387, -9.105050, -10.820718, 1.626, 0, 7, 173.0333333, 0, 1.0, 20000, 0, 0, 130000, 70000, 200000

The custom datum definition included in this coordinate system definition is made up of the following:

9999, 4, 259.418, -31.724, -3.795, -1.381387, -9.105050, -10.820718, 1.626, 0

9999 : This number indicates to MapInfo that the following custom datum definition is a '7 parameter' (Bursa-Wolfe or 3-dimensional similarity) definition.

As in the Beru definition the 4 is the international ellipsoid number and the next three numbers are the X,Y and Z shifts. The three numbers after that are rotations around the X,Y and Z axes. The number 1.626 is a scale factor in parts per million and the zero is a longitude difference.

This definition of the 'Tarawa Secor Astro 1966' datum was calculated by Queensland survey firm Schlencker mapping as part of the aerial mapping project of Tarawa in 1998. All of the surveys of Tarawa up to that time were based on that datum and this custom definition relates that datum to WGS84.

The calculation of this datum (or rather, the relationship between the 'Secor Astro 1966' datum and the WGS84 datum), was made possible by the fact that a number of control points that already existed on Tarawa and were defined on the Secor Astro datum were surveyed using control survey GPS techniques and their coordinates using the WGS84 datum established.

This 7 parameter datum definition provides a more accurate relationship (about 1 meter) between the local datum and WGS84 than a 3 parameter datum definition does. When accurate GPS control surveys are done on other islands of Kiribati it will be possible to develop more accurate 7 parameter datum definitions replacing the 3 parameter definitions that have already been calculated.

Changing over to WGS84 Datum for Tarawa Mapping

Since we have an accurate measure of the relationship between the Secor Astro 1966 Datum and the WGS84 datum it is reasonable to transform older mapping and surveys to the WGS84 datum, as well as using WGS84 for all new mapping of Tarawa. Some of the advantages of using the WGS84 datum are that the mapping conforms to a worldwide reference, users of GPS can directly relate their work to the mapping, and the position of air navigation aids are useable by aircraft using GPS.

Changing the Map Datum of an existing MapInfo Table and Transforming between different data

MapInfo tables can be exported to '.MIF' text files. The following is an example showing the first few lines of a MapInfo table of Aranuka that has been exported to a MIF file:

```
Version 300
Charset "WindowsLatin1"
Delimiter ","
Index 1
CoordSys Earth Projection 8, 9999, 4, -137, -3168, 136, 0, 0, 0, 0, 0, "m", 173.5, 0, 1, 30000, 100000 Bounds (11000, 110000) (45000, 132000)
Columns 5
  Ptnum Char(10)
  Easting Decimal(12, 3)
  Northing Decimal(12, 3)
  SRref Char(10)
  Court_minute Char(15)
Data

Point 42159.75829 119181.0403
    Symbol (40,0,9)
```

The custom datum and coordinate system take up the fifth line. (Within MIF files 3 parameter and 7 parameter datum definitions are shown the same way, but for 3 parameter definitions zeroes are placed in the position of the rotation, scale factor and longitude difference parameters). After the coordinate system comes the description of all the columns that are in the table and following that comes the data in the table. The geographical position of data in the table (only the first point record is shown) is shown in meters based on the TM projection parameters.

If this map datum is found to be changed, (perhaps the datum parameters have been relcalulated after a new GPS survey), we wish only to change the datum, the coordinate values within the MIF file are correct and should remain unchanged. So what we need to do is to edit the datum parameters in this MIF file to the new ones and then 'Import' the MIF file back into MapInfo. So if a datum definition is changed, we need to follow a three stage process:

1. Export the existing MapInfo table to MIF format.
2. Edit the datum definition in the MIF file to that required.
3. Import the edited MIF file back into a MapInfo table.

This process will leave unchanged the coordinate values of positions of objects in the MapInfo table. However, if you import a MIF file with a changed datum definition into MapInfo and then display the resulting table together with the original table, you will see a separation between them.

As we go into the future and more and more GPS control surveys are done, these old map data will no longer be used. However, for the moment, surveys on outer islands of Kiribati are still being carried out based on the old data and it will be necessary even after the old data are replaced, to transform some old surveys. So the definitions of these old data are needed, and for many of the outer islands of Kiribati they help us to better describe their 'place in the world'.

Island	***Spheroid***	***Datum***
Makin	International	Makin Astro 1965
Butaritari	International	Makin Astro 1965
Marakei	International	HMS Cook Astro 'H' 1962
Abaiang	International	HMS Cook Astro 'H' 1962
Tarawa	International	Secor Astro 1966
Tarawa	WGS84	WGS84
Maiana	International	Maiana Astro 1965
Abemama	International	HMS Cook Astro 1959
Kuria	International	HMS Cook Astro, Kuria 1962
Aranuka	International	HMS Cook Astro, Kuria 1962
Nonouti	International	Nonouti Astro 1965
Tabiteuea	International	TBZ1 Astro 1965
Beru	International	BRZ1 Astro 1970
Nikunau	International	Nikunau Astro 1965
Onotoa	International	ONZ 7 Astro 1970
Tamana	International	HMS Cook Astro 1962
Arorae	International	Arorae Astro 1965
Kiritimati	International	Christmas 1967 Astro

Table 1: *Local Data used for Mapping in Kiribati*

PCGIAP ?

Introduction

The Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP) helps develop the cooperation between the organisations applying GIS and Remote Sensing in the Asia and Pacific region. The first GIS&RS newsletter this year published an article by Bob Irwin, former Australian representative to PCGIAP. PCGIAP is a regional body established by the United Nations Regional Cartographic Conference for Asia and the Pacific. PCGIAP was formed in 1995 and membership comprises all 55 nations of the Asia and the Pacific region. Its main areas of responsibility are:

- development of a regional spatial data infrastructure and contribution to the global model;
- support for member countries with their national spatial data infrastructures (NSDIs).

The Organisation of PCGIAP

In March 1999, Pacific island representatives formed a PCGIAP Pacific Group to address their unique GIS and related needs and it was proposed that SOPAC manage the Pacific Group secretariat.

Every Pacific Island Country has a national representative and there is a representative speaking for all Pacific Island Countries on international conferences and meetings.

PCGIAP currently carries out its activities through three working groups: Geodesy; Fundamental Data; and Development Needs. The Committee established the Taskforce in 1998 to identify relevant assistance in NSDI activities. The Taskforce is running workshops and gathering information from PCGIAP member countries from which appropriate development projects can be identified in support of these activities. Cadastre is also seen an issue of regional significance by PCGIAP and it is giving serious attention to the formation of a PCGIAP cadastral working group.

And.....

SOPAC in its capacity as Secretariat is concerned as the apparent lack of focus of the Pacific Group and wonders whether this group will just become another United Nations all talk and no action organisation.

We have included what we understand are the list of Pacific national representatives. Is this list correct? What are they doing? What is the communication with GIS users? What decisions for the South Pacific were made during the international meetings?

Please help us help you to develop GIS within the region by communicating with us.

Thank you.

American Samoa	Mr Meko I. Aiumu	pat@samoatelco.com
Cook Islands	Mr Keu Mataroa	k.mataroa@mow.gov.ck
Fiji	Mr Timote Rupeni	trupeni@lands.gov.fj
French Polynesia	Mr Moana Bodin	mbodin@francemel.com
Guam	Mr Carl J.C. Aguon	dlmdir@ns.gov.gu
Kiribati	Mr Erene Nikora	PJones@tskl.net.ki
Micronesia		survey@mail.fm
Marshall Islands	Mr Robert Muller	Fax: +692 625 3005
Nauru	Mr Porthos Bop	porthbop@cenpac.net.nr
New Caledonia	M. Yves Lafoy	lafoy@noumea.orstom.NC
Niue	Mr Togia L. Sioneholo	ajm.falepeau@mail.gov.nu
Northern Mariana Islands	Ms Bertha C. Leon Guerrero	Fax: +670 288 3755
Palau	Mr. Fritz Koshiba	bls@palaunet.com
Papua New Guinea	Mr Omani B Rei	natmap@datec.com.pg
Samoa	Mr Seumanutafa Aua'u Tiavolo	seudirdlse@samoa.net
Solomon Islands	Mr Jackson Viakota	Fax: +677 26 134
Tonga	Dr Savae Latu	minlands@candw.to
Tuvalu	Fanoanoaga Patoro	fpatoro@tuvalu.tv
Vanuatu	Mr Michael Bakeoliu	landsurvey@vanuatu.com.vu