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Newsletter of the Far North Queensland GIS Group Inc

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Thank you to Bob Peever of Atherton Shire Council for arranging this interesting November General Meeting, and thanks to Bob, Andy Gleeson and Guy Carpenter of CSIRO, and Peter Ludlow of Sokkisha for their presentations. Subsequently we saw work in progress in the CSIRO laboratory.

We heard more about GPS, the US satellite navigation system. It is rapidly getting cheaper and we hope to arrange a practical demonstration soon. One way forward is for several companies to share the cost of an accurately located base station. Relative measurements can then be made up to 500 kilometres away to an accuracy better than 1 metre with portable equipment costing under $1000.00.

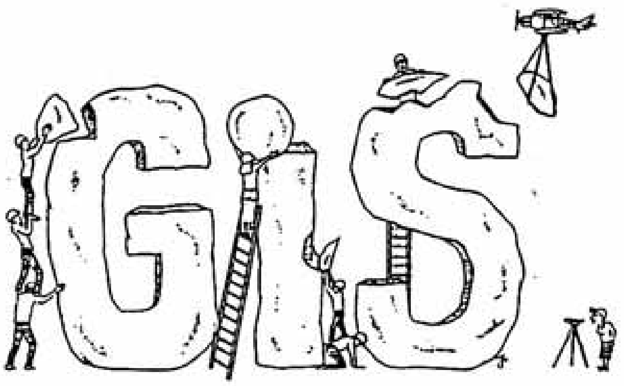
Sadly it is time to farewell our Secretary/Treasurer Peter Rey who is leaving us to take up an appointment as a Research Officer at the University of Central Queensland in Rockhampton. Thanks to Peter for the time and energy he has put into our FNQ GIS group over the past 18 months. We are fortunate that Steve Turton, Lecturer in Geography at JCU Cairns Campus is willing to step into the Secretary/Treasurer role.

As a result of this reshuffle we now need to fill a vacancy on the committee preferably with someone employed by the State Government. If you are interested, now or for next year, please let us know.

Following our questionaire last year we have streamlined our mailing list to 75. We hope to see all these people at our General Meetings held every three months.

Our next General Meeting will be held in Cairns on Friday, March 20th, 1992. Speakers are expected to include Mr D. Fairbrother of the Department of Transport to discuss the implications of painting white crosses on FNQ, and Arron Accad of the Wet Tropics Management Authority. We hope to see you all there.

Andrew Hooper



Operations Desert Shield and Desert Storm

Satellite Tracking with MapInfo

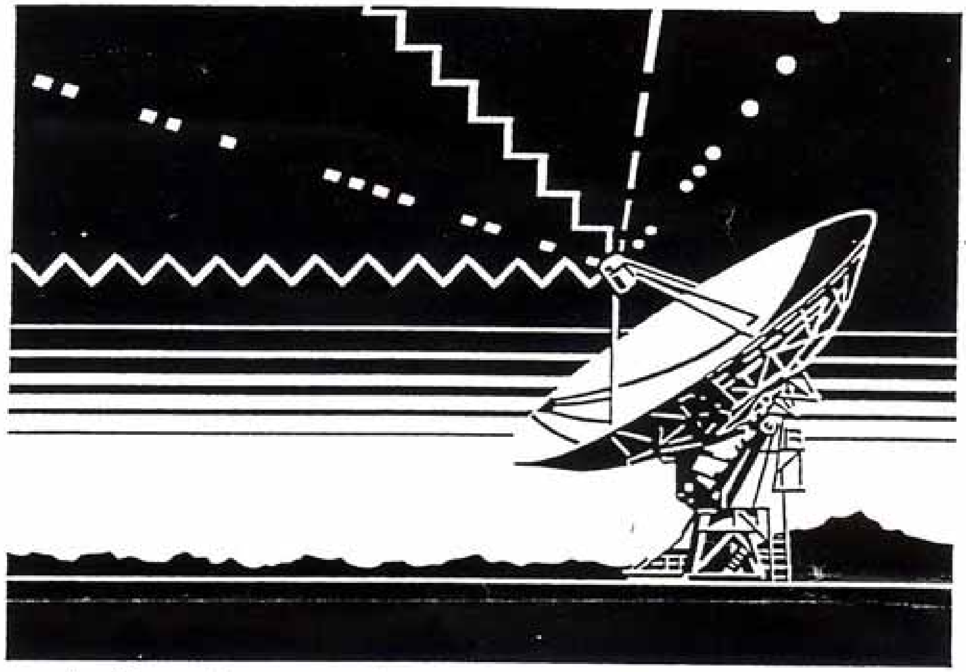
MapInfo Corporation has recently developed a Real Time version of MapInfo. It has been specifically designed to read and display electronically transmitted co-ordinates in real time.

In practical terms this means satelite tracking positions can be displayed dynamically on the MapInfo screen ie. no batch processing or time delay; immediate and ongoing display of moving objects.

The development and introduction of Real Time MapInfo is 'timely' as it co-incides with the maturing of Global Positioning Systems (GPS) into robust and cost-effective products.

The integration of MapInfo and GPS is already being extensively used in the United States. In fact, the US army used GPS in conjuction with 30 real-time MapInfo's in Operation 'Desert Storm', Kuwait last year.

ERSIS has teamed up with the vendor independant hi-tech company Mobiltrack, which will provide the GPS expertise while ERSIS provides the MapInfo and MapCode programming expertise in providing dynamic tracking solutions.



30 real-time MapInfo's were used in 'Operation Desert Storm'

Mobiletrack has successfully integrated Global Positioning System Satellite Receivers (GPSS) with communication links such as cellular telephone, mobile radio and satellite communications, to provide Australia's first real time GPS based remote tracking/position location system. In fact Mobiletrack's technology was operational before any viable system in the United States.

ERSIS has had a long association with Trimble Navigation, one of the foremost suppliers of GPS equipment in the world. ERSIS will be able to maintain this relationship as MobileTrack will be able to incorporate Trimble technology into their tracking system.

The Mobiletrack GPS Remote Tracking System has now been operational for nearly one year and enhancements have already been developed which will provide flexibility for the user well into the future.

Mobiletrack's system provides a turnkey solution to clients with a need to position locate and track their vehicles in real time. The user interface is a MapInfo based product with significant enhancements written in MapCode. This has resulted in a user interface which is simple to operate and manage providing a screen output which is both aesthetic and functional.

The 'Mobiletrack' product is available with the following features.

- Ability to store up to 28 days positional information at a sample rate of once every 10 seconds or 68 hours at one per second.
- Stored information can either be down-loaded remotely via the communications link or through the communications port.
- A journey can be programmed into the GPS with envelope parameters of position and time for that journey so deviation can initiate an alarm response transmission to the base.
- The unit may be polled at any time by the base to ascertain its position, average speed, maximum speed and the status of any onboard alarms, including engine monitoring systems.

Mobiletrack has developed proprietary software which corrects in real time, position location data from satellite (presently corrupted by the US military), providing an accuracy of plus or minus eight metres.

When integrated with MapInfo, Mobiletrack's system is able to remotely track and locate a vehicle down to street number level. The Mobiletrack system has already been successfully trialed on a NSW State Rail Network and the company is presently developing an avionics based tracking system.

Mobiletrack GPS Remote Tracking System has application with buses trains, boats, and aircraft and is an effective fleet management tool designed to assist in the economical maintenance of fleet vehicle operations.

Please contact Robert Fenwick at ERSIS for further information.

CAD

Versus

GIS

Which Is Better for Automated Mapping?

by Jack Dangermond

Potential users of computerized mapping systems often ask, "What is the difference between Automated Mapping Systems and Geographic Information System (GIS) technologies? Is there really a difference, and if so, why do users select one technology over the other?" Given the dramatic growth in sales and use of both of these technologies, it is important to clarify their differences as well as how they can be interfaced.

Historically, there has been a series of rather distinct technical differences. Most of these differences remain, but we are seeing major efforts by commercial vendors to present their technology as "all encompassing." We are also seeing vendors acquire and develop both sets of capabilities.

This article provides the author's views of the distinctions between these systems and the general trends in research and commercially available tools.

CAD Technology Automates Drafting Function

In the short history of commercial computer mapping systems, we have seen that nearly all of the early approaches for automating, organizing, and drafting map data used computer-aided drafting (CAD) technology with particular emphasis on interactive graphics system functionality.

This CAD technology was initially designed to serve the generic need for automating the drafting function. Because maps are certainly a broad class of drawings, CAD was used early on as a tool for increasing worker and organizational productivity in map generation and maintenance.

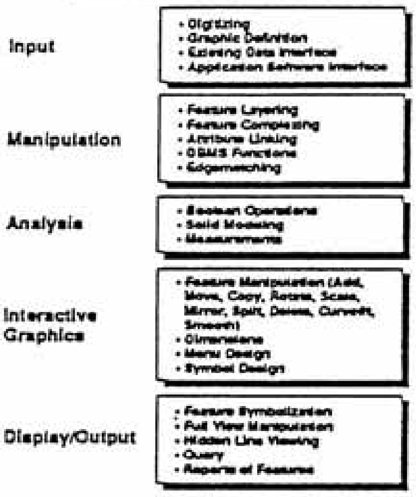
The CAD database model treats spatial information as electronic drawings that are made up of graphic features organized into "layers." The user enters map features using primitive drawing elements of their own symbols that may be compositions of the primitive drawing elements. Simple features, such as lines and polygons, are stored as coordinate points. More complicated data are stored as points with mathematical expressions that define a shape, such as a circle, spline, arc, and box.

In the early graphics systems applied to mapping, the data model was very simple and consisted almost entirely of symbolized graphic features. In this model, the features were represented by the graphic symbol initially chosen. In later versions, the data became more intelligent. Nongraphic attributes were stored as separate tabular data that could be queried and used to manipulate the display.

Graphic system software allows the map files (often referred to as layers) to be edited, manipulated, displayed, and generally managed. Figure 1 outlines in very general terms the categories of functionality typically provided.

Although the initial purpose and application of graphic systems have been the automation of the drafting function, they have evolved into more general-pur-

Figure 1
CAD SOFTWARE TOOLS



pose map data management tools. These tools have become particularly popular in the automated mapping/facilities management (AM/FM) world and have been heavily invested in by many organizations, particularly utilities and telephone companies.

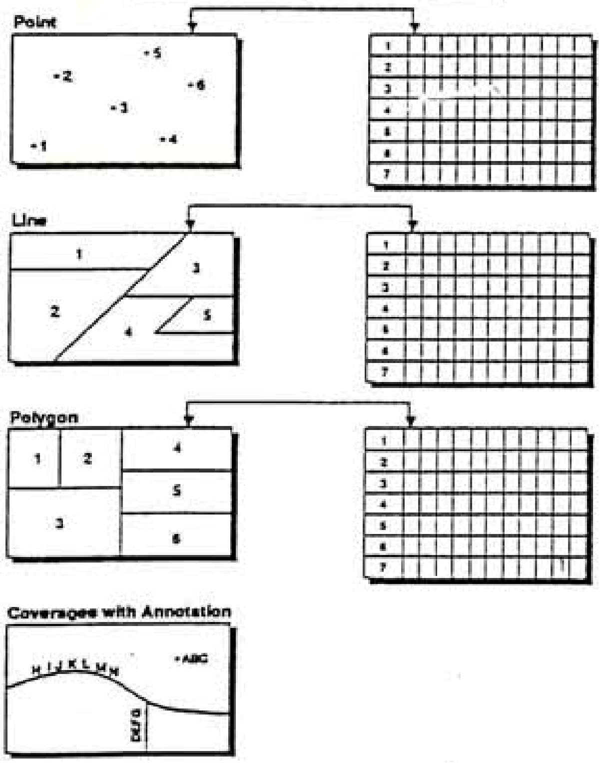
However, although automated map drafting and general management of map information has delivered significant benefits to government and private organizations, general-purpose, spatial data management requires a database structure and software technology beyond the graphic functionality offered by CAD solutions.

GIS Technology Fills Gap Left by CAD Systems

In the early 1960s, a group of theoreticians working for the Canadian government developed a separate software technology concept known as GIS. GISs were originally designed to manage large collections of natural resource and environmental information. More recently, they have been developed to support information management closely associated with urban and land records applications. This technology is now embodied in several commercial products and has become an alternative way to perform automated mapping.

A GIS data model involves storage of tabular data (attributes) in association with very simple cartographic features (points, lines, and polygons). Figure 2 is an example of how these data are typically organized. Notice that cartographic data are stored as a table in nonsymbolized form and in "relation" to other attributes. ARC/INFO software, produced by Environmental Systems Research Institute, Inc. (ESRI), typifies this data model.

Figure 2
DATABASE CONCEPT



The purpose and use of these systems were primarily focused on the entry, management, manipulation, analysis, query, and display of large collections of spatial data. GIS software tools (Figure 3) are typically organized around a GIS database to provide multiple users with "views" to the database (Figure 4).

The data model for GIS technology, while similar to a CAD approach in that it uses coordinates, is fundamentally different in its simplicity and approach. Common to the GIS type of system is the use of

Figure 3
GIS SOFTWARE TOOLS

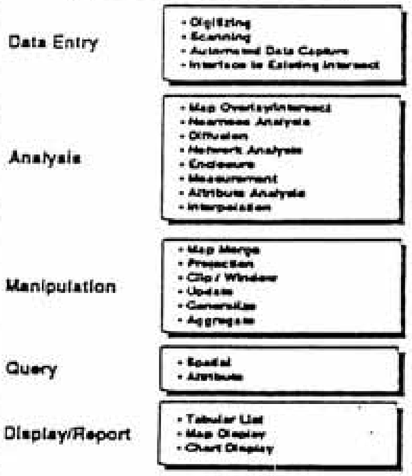
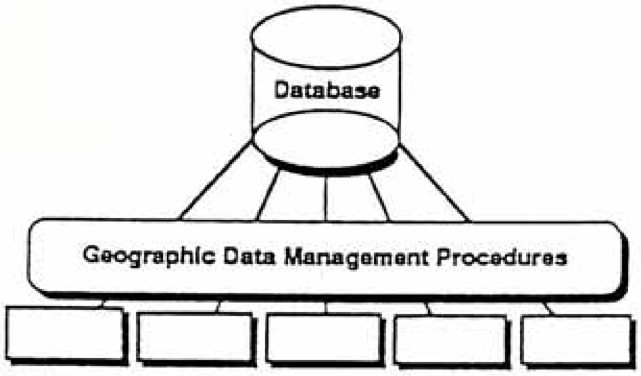


Figure 4
GEOGRAPHIC DATA MANAGEMENT PROCEDURES



topology (networks) to store relationships among various spatial objects. Topology involves the use of graph theory to abstract and relate cartographic objects using a series of arcs and nodes. This type of data model represents a different and, for many applications, superior structure for geographic data management as compared with the "graphics model."

GIS Offers Greater Flexibility

A GIS system can be used as an automated drafting tool. However, rather than simple storage and regeneration of graphics, a GIS involves plotting of all displays based on information maintained in a database format. Rather than store map features as graphic symbology, a GIS data structure organizes features with descriptive characteristics. Software tools are used to extract and display, in graphics format, the objects contained in the database. Users can automatically relate shading and graphic symbols to cartographic primitives based on lookup tables that relate attributes and predefined table symbology. This allows the user the flexibility to associate the symbology of choice with the cartographic objects based on attributes in the database. This means greater flexibility for end users, particularly in a multidepartmental setting.

For example, in a municipality, a planning department may wish to create a map that colors land ownership parcels according to land use attributes. Using the same database, the tax assessor can display the dimensions, book, page, and parcel numbers to a parcel polygon. Finally, the public works department can see the same parcels with dimensions automatically plotted for each of the parcel boundaries. In a GIS system, such as ARC/INFO, all of these views can be very simply generated from a single parcel boundary associated with a list of appropriate attributes.

GIS Manages Large Collections of Spatial Information

Beyond flexible graphic tools, a GIS is primarily focused on managing large collections of spatial information. Software tools are included that allow geographic data covering large areas to be efficiently organized, queried, and displayed. Also, a GIS system includes a host of analytic and manipulative tools that are difficult or impossible to perform in a graphically structured database. These functions include tools such as automatic identification of relationships between and among maps, selection of optimum path in a line network, and analysis of flows across terrain.

These tools are often used for applications such as forest management modeling, automated tax assessment, transportation planning, land use and environmental planning, natural resource forecasting, engineering design, and vehicle routing.

Common to all of these applications is the integrated spatial information base that is required and the analytic software tools necessary to support them. A GIS links these together in such a way that meaningful products can be generated.

GIS Provides Special User Interface

However, for the user to use these tools effectively, the GIS must be designed with special attention to the user interface. Unlike CAD and automated mapping systems, a GIS has tools for developing macros and customizing commonly performed procedures. For example, the ARC/INFO software was recently enhanced with the ARC Macro Language (AML), a user-friendly command language that is independent of the host operating system. AML simplifies processes such as writing long pathnames and developing application macros. It also gives the user the option of creating pulldown menus and popup sidebars for selecting commonly used commands.

Recently, several of the large, automated mapping vendors have announced that they have, or are building, GIS products that complement their automated graphic software. Although it is clear that these types of solutions are required by users of automated mapping, it is also clear that these types of solutions (i.e., a duplicate GIS linked to an automated mapping system) introduce a number of technical problems, including database redundancy; the need to translate from graphics to topological and back to graphics data structures; and related data management integrating issues.

Other Vendors Provide Inadequate Solutions

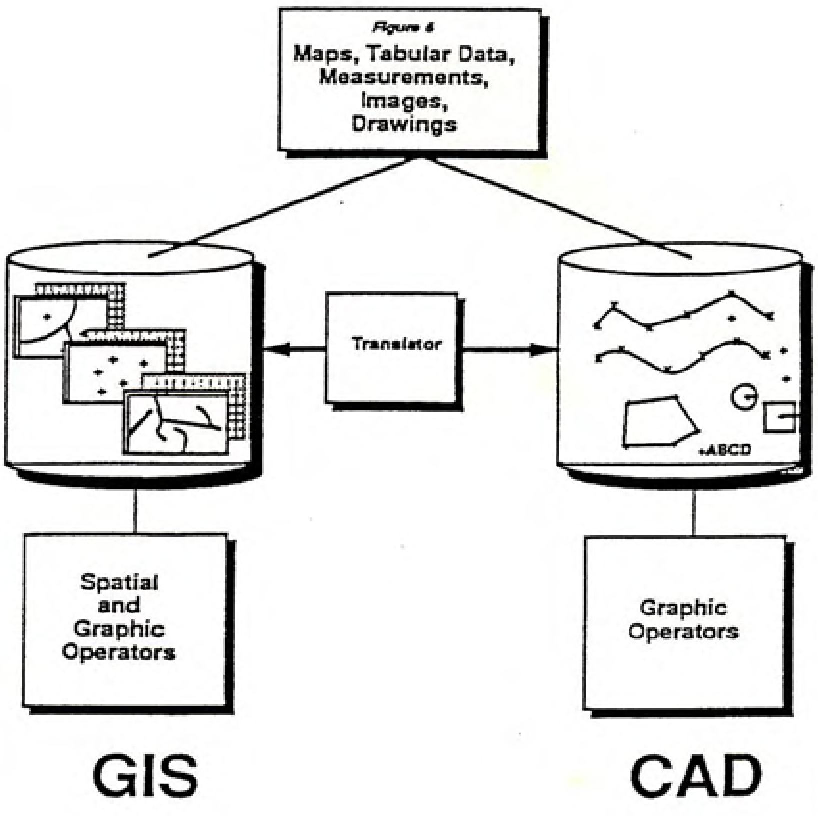
This dual system approach is particularly questionable considering the substantial improvements in automated mapping functionality and graphic quality now produced by the newer GIS products. Newer buyers are selecting GIS as the core database and avoiding the problems and issues of redundant data.

Interface Between GIS and CAD Needed

At present, there are major investments in both GIS- and CAD-based digital mapping systems. While we see a shift toward the GIS approach, we also see the need to build interfaces between the two database systems, such as the interfaces now available between ARC/INFO and Prime MEDUSA, AutoCAD, and other CAD systems. Figure 5 shows how such an interface works. It is based on the concept that users can rapidly transfer data between the two data models. This interface will become increasingly important in the next several years.

In my view, the analytic and database approach represented by GIS technology provides a much more sound basis for general geographic data management. It not only assists in map automation for drafting, but also results in a general-purpose information system suitable for a host of applications that require the construction and analysis of database relationships based on geography.

Jack Dangermond is the founder and president of Environmental Systems Research Institute, Inc., Redlands, CA.



Hawaii Forestry Project Assisted by MapInfo

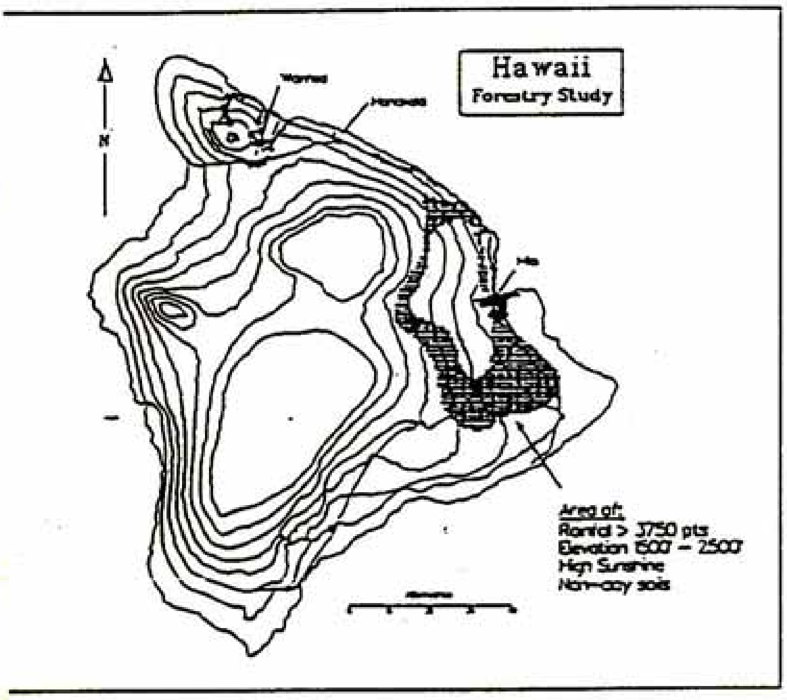
MapInfo was used in a recent project to assess suitability of land in Hawaii for reafforestation. The project outlined MapInfo's ability to capture and analyse topographic and environmental data and then develop conclusions based on information in many different layers. This process, traditionally known as polygon overlay, was facilitated by MapInfo's ability to pass information from Polygons to points, and then to filter and thematically map those points. Using this technique, easily visualised shaded maps were developed that showed the relationship between information in the separately collected layers.

How does the whole process actually work ? The key to the system is in the initial collection of the data. For the Hawaii project, key topographic features were initially collected showing information such as coastline, major roads and population centres, and contours. Boundaries describing key environmental factors were digitised as layers over this base map. Layers digitised included Insolation (Solar Radiation), Climate, Rainfall, Elevation, Soil types etc.

With this data captured, it was a simple matter to collect this information into an integrated grid of points that could describe the conditions at any given location. This grid was then queried to ask questions such as "Show me all the land above 2500',with an average yearly rainfall of more than 1200mm and less than 2200mm." Using this type of query allowed the production of maps highlighting possible areas that might be suitable for development as new forestry. Another layer of the database was areas of existing forestry so that areas would not be recommended for development if they were already being used for forestry !

The map accompanying this article highlights a standard query that was developed using the data collected for the project. MapInfo proved its suitability to task in a number of aspects in this project. The ability to perform updates on the main grid point database using polygon overlay meant that queries could be quickly and easily performed on information in a number of separate layers. These queries could then be easily edited and re-processed to make the analysis criteria more or less restrictive. These MapInfo queries are developed in a "dBASE like" filter and can be easily specified and understood. MapInfo's thematic mapping capabilities then allowed the consultants to see ranges of data within areas delineated by the original query. Thus, visualisation of questions such as "Show me the distribution of rainfall across all suitable elevations" was simple and easily updated to account for other factors.

This project illustrates MapInfo's ability to handle the diversity of data that may need to be collected in an Agricultural or Environmental Application and then present the user with tools to easily visualise and analyse this data in intelligent ways.



The Far North will certainly miss Peter Rey as he takes up his new position as Research Officer with the University of Central Queensland - Faculty of Applied Science.

Having worked in the Far North Regional Office of the Department of Lands for two and a half years, Peter contributed much expertise to the local Geographic Information Industry.

During his time with the Department of Lands he worked on four major projects.

(i) Evaluating Landsat TM data for property mapping used in farm planning.

(ii) Evaluating Landsat TM data for locating and quantifying the area of tobacco and orchard crops planted in the Mareeba Dimbulah Irrigation area.

(iii) Evaluating TM data and GIS for mapping coastal vegetation communities in the Cairns Region.

(iv) Evaluating high resolution airborne spectral data for improving sugar cane tonnage (biomass) estimates.

As Peter's dedication to assisting others with work was limitless, many people have received extensive training on Remote Sensing and GIS in his time with the Department of Lands.

Peter took on the role of Secretary/Treasurer of the FNQ GIS inc. in February 1991. During his time as Secretary/Treasurer he co-ordinated the very successful 1991 Annual Seminar.

Peter's new position with the University of Central Queensland will require him to operate an Image processing system and undertake remote sensing work for Departments within the University. He will also be responsible for the promotion of remote sensing and GIS outside the university and provide a consultancy service to interested parties.

We take this opportunity to thank Peter for his contribution of his skills, talents and expertise to the Far North GIS Industry and wish him all the best in his new venture in Central Queensland.