NATIONAL REPORT FOR THE 17TH ISPRS CONGRESS, ZIMBABWE 1992

by Mr K Philip (Committee Chairman) & Mr T Heath (Committee Member)
of the Zimbabwe Society for Photogrammetry, Remote Sensing & Cartography
Dr H Kaufmann, *Technical Expert in the National Remote Sensing Facility*
Mrs K Rogers *Chairperson of the National Committee for Land and Geographic Systems,*
and Mr D P Goodwin, *Lecturer, Dept of Surveying, University of Zimbabwe*

This First National report overviews the nation's activities in photogrammetry and remote sensing and gives some details of the relevant institutions. Zimbabwe's inaugural year of membership to ISPRS coincides with the Department of the Surveyor-General's 100th anniversary, indicating the long involvement with surveying and mapping. This government department is responsible for national topographical mapping but air photography is contracted out to the commercial sector who also satisfy the demand for large scale engineering mapping and orthophotomapping. Elements of photogrammetry and remote sensing are taught within diploma courses at the Harare Polytechnic and to a more advanced level in the BSc Survey course at the University of Zimbabwe. Short courses in remote sensing are done at the University of Zimbabwe and the NRSF with co-operation from the Department of the Surveyor-General. Much interest in GIS has been generated and this led to a multi disciplinary National Committee for Land and Geographical Information Systems (LIS/GIS) being established. It currently operates under the aegis of the Surveyor General. In some organisations a start has been made to the collection of data in a digital format. The Zimbabwe Society for Photogrammetry, Remote Sensing and Cartography (ZIMPRAC) which is the body representing ISPRS in Zimbabwe and the compiler of this report, is a society that facilitates the meeting of people who are practising or interested in the mapping sciences.

INTRODUCTION

Zimbabwe is a nation covering an area of 390 000 square kilometres and comprises a wide variety of physical characteristics.

As a young nation in the throes of development, Zimbabwe is most fortunate to be relatively well mapped. The Department of the Surveyor-General is the principle topographic mapping authority and has been in place for over one hundred years. The first map produced by the department to cover the whole country was published in 1902. A copy of this map, together with many others, was on display at an exhibition mounted by the Department of the Surveyor-General in 1991 to celebrate 100 years of surveying and mapping.

Amongst the notable achievements of the Department are:

1. An excellent and secure land registration system resulting in no litigation over land to date.
2. A national trigonometrical system (instituted in 1897) allowing all surveys to be connected to a common system.
3. Total 1:50 000 map coverage which commenced in 1936 and completed in 1973. Most of these maps have since been compiled on stereoplotters.

1991 was also the year that Zimbabwe became a member of ISPRS.

Since gaining independence in 1980 Zimbabwe has attracted much attention from the developed world who have been keen to assist the nation in areas of mapping. The Department of the Surveyor-General benefitted from a mapping project funded by the Canadian Government. A National Remote Sensing Facility has been set up under the Department of Geological Survey with German aid (G.T.Z.). The same aid agency has helped to establish the Department of Surveying at the University of Zimbabwe. All in all, this has led the way to some new mapping technologies being introduced, and much interest has been generated in Geographical Information Systems.

The Zimbabwe Society for Photogrammetry, Remote Sensing and Cartography is the body that subscribes to ISPRS. The Society runs under the direction of a committee which is elected annually by its members. Membership is currently about 40, most of whom are not actually practising in photogrammetry or remote sensing but rather people who have developed an interest in the mapping sciences.

ACTIVITIES IN PHOTOGRAMMETRY

National Mapping continues to be carried out in the Department of the Surveyor General where data collection is still mainly by analogue stereoplotters. One second order stereoplotter has been linked to a mini computer and data for the 1:5 000 series of the urban centres is being captured digitally. The aim is to develop automatic scribing and enhancement and thus speed up the production of this important series. The Department is also compiling a data bank of cadastral and photogrammetric co-ordinates and attributes.

Computer hardware and software were received as part of an agreement whereby Zimbabwe also received aid in the form of small scale aerial photography of the whole country, orthophotomapping, and technical education from the Canadian International Development Agency.

The Ministry of Transport recently installed an analytical stereoplotter and aerial triangulation software through Italian aid. It is being used to compile mapping of projected road routes.

The University of Zimbabwe now has an analytical plotter and an analogue plotter with a semi automatic table. Aerial triangulation is by the Bundle Adjustment method. Technicians and students have completed a map of the University Campus and are hoping in the future to use terrestrial photogrammetry to help monitor the deterioration and repair of the ruins at Great Zimbabwe. Photogrammetry instrumentation, computer hardware and software, and technical education were received through a West German Aid agreement.

A commercial air survey company carries out the large scale development and engineering mapping required by the country. At present analogue stereoplotters are used for aerial triangulation and data collection. Orthophoto-mapping is carried out and the company has its own aircraft and photolab, to satisfy the aerial photography requirements of its own mapping and that of other agencies. The company is hoping to move into the digital mapping field in the near future.

GEOGRAPHICAL INFORMATION SYSTEMS AND DIGITAL MAPPING

Geographical Information Systems are a very new area of technology in Zimbabwe but a start has been made to nationally co-ordinate activities in GIS.

A National Committee for Land and Geographical Information Systems (LIS/GIS) was formed in response to a call in 1989 by a senior member of the Department of the Surveyor-General. This National Committee (which reports to an Executive Committee) includes members from government and local government departments, technical and academic institutions and commercial companies, and currently operates under the aegis of the Surveyor-General.

The aims of the National Committee are primarily concerned with the co-ordination and methodical development of LIS/GIS technology in Zimbabwe. At the first seminar on LIS/GIS entitled "Concepts and Issues for Zimbabwe Decision Makers" the Chairman of the Department of Surveying, University of Zimbabwe said that the survey control network and existing mapping provided the essential components to embark on a nation wide land information system. The second LIS/GIS seminar entitled "Users and Uses" concluded with a number of recommendations, most of which the Committee has adopted as a mandate.

Forging close ties with the user/potential user group, keeping all parties informed of activities through information publicity, establishing standards and encouraging adoption of a common referencing system and symbology are the main points of the mandate. So far, in response to the mandate, the Committee has produced a draft policy document for national LIS/GIS but the document will be under a process of evolution for some time to come. The Committee has expressed its intention to become a component of the Research Council of Zimbabwe with the Committee for Remote Sensing, but may later seek total autonomy. A newsletter has been established to fill its information dissemination role, and a subcommittee has been set up to evolve standards, geocodes and common boundaries. The Committee is in touch with a number of organisations, both locally, regionally and internationally with the intention of learning and gaining direction from similar existing facilities. The Committee is currently compiling a list of users and uses within Zimbabwe and hopes to receive technical and administrative assistance for a number of projects, through the World Bank Committee for Environmental Information Systems.

Digital Mapping is also in early stages of development. There are three photogrammetrical stereoplotters in the country that are able to collect information digitally. A Planicart E3 at the Department of the Surveyor-General is linked via computer to Resource & Analytical Mapping Systems (RAMS) software. Large scale mapping is plotted and simultaneously stored in map files which are then edited at interactive workstations. The map can then be automatically scribed on a flat bed plotter. Automatic scribing is, however, very limited due to the poor selection of scribing points.

A large proportion of all the cadastral information of the country has been entered into map files. Each file covers 1/32 of a degree square. All of the control network including trigonometrical stations, town survey marks and other bench marks, together with the attribute information, are stored in vector computer files.

The Zeiss analytical plotter at the Ministry of Transport, used for large scale mapping along proposed road sites, collects digital topographic detail in the autocad files which are then passed to the engineering section to calculate (engineering) solutions for road construction. The maps are output on a drum plotter.

Some large scale digital maps have been compiled on the Department of Surveying's Zeiss analytical plotter. Most of these have been done as exercises by students.

Soon the Department will provide some digital map sets to the Institute of Mining Research as part of a joint project.

A number of other Government Departments have already invested in small systems which facilitate the digitising of existing maps for the addition of other data sets. The primary function of these systems is to develop information systems.

DEVELOPMENTS AND ACTIVITIES IN REMOTE SENSING

The establishment of the National Remote Sensing Facility (NRSF) in Zimbabwe is a joint Technical Co-operation project between the government of the Republic of Zimbabwe and the Federal Republic of Germany. Phase 1 of the project started in April 1988. The NRSF is now in its second phase. Duration of German support for the project is about eight years.

The project is executed by the Geological Survey Department, Ministry of Mines, and the German Agency for Technical Co-operation (GTZ) on behalf of their respective governments.

In the long term, the establishment of a remote sensing centre in Zimbabwe is to contribute towards improved utilization of the country's natural and economic development potentials. Furthermore the activities are extended beyond the country's borders to the whole Southern African Development Co-ordination Conference (SADCC) region.

The overall objective of the NRSF is the establishment of an autonomous, fully operational remote sensing centre, based on numerous activities defined by the user community.

Target groups are government departments, non-governmental organisations and the private sector. To date, contact has been established with more than forty departments and organisations.

The NRSF has a number of roles to play in the promotion and co-ordination of remote sensing activities. It maintains contact with all relevant organisations and committees in Zimbabwe and actively liaises with other users and facilities in the region and overseas. The NRSF participates in and facilitates local Zimbabweans to participate in international conferences on behalf of the user community. It also organises seminars and workshops in remote sensing and provides input and funding to associated disciplines such as GIS.

The NRSF is equipped with several PC workstations, ERDAS and ARC/INFO software, several input/output devices, an Optronics colour filmwriter, field spectrometers and GPS instruments, and hardware for data evaluation. In addition, a complete colour photolab equipped with enlargers and film and paper processors (geared towards Cibachrome P3) is fully staffed and operational.

Initially, pilot projects were carried out to determine the extent of the user community's requirement, and to justify the large investment. In addition to the high number of pilot projects, numerous research and funded projects for various disciplines (land use, forestry, mining sector, erosion problems) have been carried out during the current phase. Computer access, logistics and technical as well as scientific support has been given to numerous local departments and associated users as well as to several researchers from foreign countries such as FRG, USA, Sweden and UK.

Specifically, the NRSF is principally responsible for the acquisition, distribution and storage of data as per user requirement. The facility will provide a comprehensive library of imagery as well as an active consultancy service to users. Advice and assistance and the formulation and execution of projects is another important part of the service. Technical services include photo enlargement of images, tape or disc copies of digitised data and also film writer output.

EDUCATION AND RESEARCH

Intermediate and full diploma courses offered in Surveying and in Cartography at the Harare Polytechnic include basic courses in photogrammetry and remote sensing. Students who have gained excellent results and show exceptional aptitude in practise are given the opportunity to attend colleges or universities overseas to gain higher qualifications.

The National Remote Sensing Facility provides in-house training for remote sensing and geographical information systems. Basic and intermediate courses are held about 3 times a year and in the near future advanced courses will also be conducted. Training is organised for image processing and interpretation, database construction and management, and programming of user defined algorithms.

The N.R.S.F. organises seminars and workshops (sometimes in cooperation with the Dept of the Surveyor-General) and arranges for its computer and photolaboratory technicians to attend formal training courses in their respective fields.

Remote Sensing theses are supported by the N.R.S.F. and they will also provide lecture material for various courses.

Research work is done in cooperation with the university and applied areas of research include:

(i) collaboration of local feature, ie. basic reflective research

(ii) integration of remote sensing with other geographic data (G.I.S.).

The University of Zimbabwe's Department of Surveying has only been in existence since 1985, with courses in Photogrammetry having been offered since 1986. Initially the Department held no photogrammetric equipment, and practical work was done at the Department of the Surveyor-General (DSG). However the following equipment has kindly been donated by GTZ:

- Zeiss E3 Planicart analogue stereoplotter.
- Zeiss P3 Planicomp Analytical Stereoplotter plus accessories (MicroVAX 11 computer, Tektronix monitor, PHOCUS, BLUH and BINGO software)
- Zeiss EZ4 flatbed plotter
- Hewlett Packard DraftMaster 1 A0 drum plotter

In 1991 a short course of two weeks was held at the Department at which visiting experts from Germany trained Zimbabweans in the use of various software packages.

The Department has had three Photogrammetrists over the last six years, as their services have proved particularly difficult to retain. At present a staff development fellow is completing postgraduate studies in Photogrammetry and Cartography at the University of Glasgow in the United Kingdom. A technician trained in

Photogrammetry has had the opportunity of further training on Zeiss equipment in Germany. The Department has a technician who trained in Remote Sensing at Aston University in the U.K.

Regarding curriculum development, 1993 should see an amended curriculum which extends the Remote Sensing component of Photogrammetry. Two years of Photogrammetry and Remote Sensing will be offered in the course, and an optional course of Terrestrial and Close Range Photogrammetry will be offered in the final year.

SCIENTIFIC AND PROFESSIONAL ASSOCIATIONS

1. The Zimbabwe Society for Photogrammetry, Remote Sensing and Cartography
   P.O. Box B.E. Belvedere, Harare, ZIMBABWE

2. National Committee for Land and Geographical Information Systems
   c/o Dept. of Surveying, University of Zimbabwe, P.O. Box MP167, Mount Pleasant, Harare, Zimbabwe

3. Research Council of Zimbabwe – Committee for Remote Sensing
   The Scientific Liaison Officer, Box 8510, Causeway, Zimbabwe

PUBLICATIONS

BUJAKIEWICZ, A. (1988); *Remarks on the Industrial Applications of Photogrammetry.* Journal of the Zimbabwe Institution of Engeneers, Vol. 26 No. 2

BUJAKIEWICZ, A. (1988); *Medical Applications of Photogrammetry.* The Central African Journal of Medicine, No.3

BUJAKIEWICZ A. (1988); *On the Application of Simple Photogrammetric Methods for the Registration of Rural Land in African Countries.* XVI ISPRS Congress, Kyoto.

BUJAKIEWICZ, A. (1988); *The Moire Technique in the Control of Epidemic Spinal Curvature.* XVI ISPRS Congress Kyoto.

BUJAKIEWICZ, A. (1988); *Automation in Photogrammetric Map Complilation.* 1st National Symposium on Science and Technology, Harare.

EZIGBALIKE, I.F.C. et al (1988); *A Land Information System Development Methodology.* Proceedings of the Annual Conference of URISA, Los Angeles.

EZIGBALIKE, I.F.C. et al (1989); *Managing a Multi-user Land Information System.* Proceedings of the Annual Conference of URISA,Los Angeles.

EZIGBALIKE, I.C. and F.T. CHUNGA, (1988); *Definition and Components of LIS/GIS.* LIS/GIS Seminar, UZ.

EZIGBALIKE,I.C. (1989); *Management Issues in LIS/GIS Development.* LIS/GIS Seminar, UZ.

EZIGBALIKE, I.C. (1989); *Recruitment for Success in the Development of Geographic Information Systems in Zimbabwe.* IUCN Workshop, Harare.

EZIGBALIKE, I.C. (Editor) (1989); *LIS/GIS Concepts and Issues.* Proceedings of a Seminar for Zimbabwean Decision Makers, Departmental Publication No. 3 (TR.No.2) July 1989.

BUJAKIEWICZ, A. (1989); *Sources of Land Related Data.* LIS/GIS Seminar, UZ February 1989.

MICHALCAK, S. (1989); *The Role of Land-Related Information in Governmental Administration.* LIS/GIS Seminar, UZ.

LUGOE, F.N. (1990); *Control Surveys and Base Mapping in Support of LIS/GIS in Zimbabwe.* AVN Journal, 7/90 International Edition.

GOODWIN, D.P.; OLTHOF, W.; PHILLIP .K. (1991)(Eds) *Institutional Concerns and Opportunities in LIS/GIS.* University of Zimbabwe, Harare.

GOODWIN, D.P. (1991); *An Information System for the Communal Lands and Resettlement Areas of Zimbabwe.* Paper presented to 3rd LIS/GIS Seminar, University of Zimbabwe.