

NEW TRENDS IN SURVEYING EDUCATION IN ZAMBIA

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ABSTRACT

New trends in surveying and mapping technologies in African countries have required a course structure of undergraduate and postgraduate University programmes to be changed. The demand is growing for graduates to be skilled not only in traditional methods of mapping and cadastral surveying but also in numerical methods and applications software to meet the requirements of the new surveying and mapping technologies and in spatial data management for the support of land and geographical information systems.

This paper gives a brief analysis of the reformed curriculum for the undergraduate surveying programme and the new developments in surveying, mapping and computer equipment and software which have been recently introduced at the Department of Surveying, University of Zambia.

1. INTRODUCTION

The development of African countries requires a great number of well educated surveyors in order to introduce the modern technics to all mapping, cadastral and engineering surveys. The new technologies had reduced the labour intensity of the traditional methods of surveying and mapping. At the same time demands were growing for graduate surveyors with the fundamental knowledge of microelectronics, sensor technology, computer science and software development to support the new technologies and for people skilled in spatial data management for the support of land and geographical information systems. The professional requirements for a surveyor have changed completely because of the rapid advancements in electronic data acquisition and processing /2/. The process of implementation of the new technologies in the African countries is quite slow mainly because of limited funds for modern surveying equipment and mapping systems, expensive application software and proper staff training. However, some funds for modernization of technologies are usually available from the external aids donated for projects of the national importance. There are some other reasons, such as an ignorance or reluctance which restrain the implementation of the new tools and procedures to survey works. Therefore, there is the urgent need to increase the knowledge and interest of surveyors in the new surveying and mapping technics. Also with the new promising fields of applications, surveyors have to understand the professional tools and product requirements of experts from other disciplines. School of Natural Sciences and one year of General Engineering programme in the School of Engineering students can choose the Land Surveying programme as one of five engineering programmes.

Due to the fast change in technology, methodology and required products, in learning institutions in African countries are obliged to secure a solid and modern education for students by introducing all the new aspects of the changed technologies to the surveying programmes. The undergraduate Land Surveying programme at UNZA has been modernized since 1989 in respect to curriculum, equipment and staff training.

2. THE NEW CURRICULUM OF THE LAND SURVEYING PROGRAMME AT UNZA

The Land Surveying programme at the University of Zambia was established in 1982 with the technical support from the Swedish International Development Authority (SIDA). At the beginning, the Land Surveying programme had been within the Department of Civil Engineering and since October 1988 it has been a separate Department of Surveying in the School of Engineering.

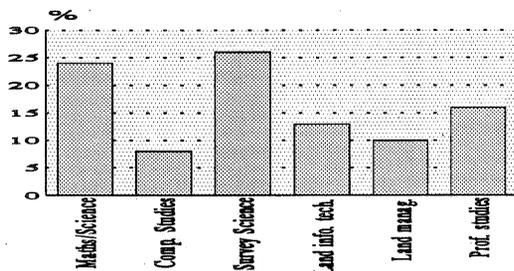
The Bachelor programme at UNZA takes five years. After one year study in the general, and also the requirements received from various institutions in Zambia regarding training of surveyors in the fundamentals of surveying science with understanding of computer skills and the structures of spatial data, the Department of Surveying had to decide to reform both curriculum structure and course content of the undergraduate Land Surveying programme. In consequence, since 1989 the Department has moved to introduce a restructured undergraduate course designed to meet those demands. Classifying, after E. Leachy / 3 /, all subjects of the new curriculum into six groups the results have been received which are shown in table 1.

TABLE 1 Classification of Subjects

GROUP	COMPRISING SUBJECTS
Mathematics and Science	mathematics, statistics, physics and mechanics, electrical and electronics
Computer Science	computer science, computer systems, programming
Surveying Science	plane surveying, advanced surveying, engineering surveying, geodesy, photogrammetry
Land Information Technology	cartography, remote sensing, land and geographical information systems
Land Management	land law, cadastre, land resources planning, soil science, roads and hydraulics
Professional Studies	engineering, management and society, engineering and communication, project

The amount of content in six groups is shown in figure 1.

FIGURE 1. Course content in six groups



University of Zambia is compared with those at the University of Melbourne and the University of Calgary* / 4 /. (* Data for this comparison have been extracted from the report /Krakowsky, 1987/ and has been reclassified by F. Leachy for comparison with data from the University of Melbourne). The content of the two last groups of subjects (see table 1), in case of University of Melbourne and Calgary is slightly different from that at the University of Zambia. The Land Management group comprises land law, cadastral surveying, land development and administration, land economy, town planning, ecology, geology, environment assessment. The Professional Studies group includes written, verbal and graphic communication, economics, management, project planning and minor thesis.

In table 2, the course content for the reformed Land Surveying programme at the

TABLE 2 Comparison of Various Surveying Programmes

INSTITUTION GROUP	UNIVERSITY OF ZAMBIA in %	UNIVERSITY OF MELBOURNE in %	UNIVERSITY OF CALGARY in %
Mathematics and Science	24	20	31
Computer Studies	8	16	4
Surveying Science	26	23	40
Land Infor. Technology	13	9	6
Land Management	10	17	5
Professional Studies	16	15	14

As it can be seen from table 2, the relations between different groups of subjects in the new curriculum at the University of Zambia are similar to those

at the University of Melbourne. In both programmes, there is a tendency to increase Land Management, Land Information Technology and Computer Studies groups and decrease Surveying Science subjects. These programmes are expecting to meet the

growing demand for graduates with a thorough understanding of surveying science technics and spatial data structures and with a training in computer science.

Proper use of land which is a basic resource in Zambia and other African countries can not be achieved if it is not backed by adequate planning and proper land policy. To make any effective plan for the proper land use, up to date information system is needed. Therefore, an involvement of properly educated surveyors in planning and implementation of such systems is required.

3. UNDERGRADUATE SERVICE COURSES, SHORT COURSES, WORK SHOPS, POST GRADUATE COURSES

The reformed surveying course has been also implemented to the other undergraduate programmes at UNZA, such as Civil Engineering, Mining, Agriculture, Agriculture Engineering, Geology. This course, which is also offered by the Department of Surveying, comprises two parts. The first part is common for all programmes and includes fundamentals of surveying methods and equipment. The second part is different for various programmes and includes principles of engineering/ mining surveys, photogrammetry and mapping, remote sensing, land use planning and information systems.

In the past few years the Department of Surveying has been also required to arrange different short refresh courses and work shops for various institutions in Zambia. These courses and workshops have covered the areas of advanced surveying, computer assisted cartography, computerization of cadastral surveys, applications of photogrammetry and remote sensing, LIS/GIS principles. Also there is a very close cooperation in respect to

share the views on the scientific and practical aspects of various professional problems, carrying out the common research pilot projects within the students final year projects and consultancy activity and arranging the seminars. The requests are growing up from different specialists for establishing the postgraduate courses in fields of information systems and remote sensing for different applications. The Department of Surveying will start such postgraduate courses in the coming years if the staff situation is improved.

4. THE INTEGRATED COMPUTER SYSTEM IN THE DEPARTMENT OF SURVEYING, UNZA.

The demands of the governmental and private institutions in Zambia regarding the changes in long and short term training of surveyors and the growing interest of other specialists to be train in surveying, photogrammetry, remote sensing and information systems, had impact on a decision to modernize the equipment in the Department of Surveying at UNZA. During the last three years, with the support of SIDA (Sweden) and CICAT (the Netherlands) the integrated computer system has been set up in the Department to solve simple surveying and mapping tasks as well as more complex problems as a creation of information systems with data captured from graphic or photographic maps, three dimensional photogrammetric models, field observations and remote sensing sources. The system has been designed for a large variety of applications and combines the components available presently in the Department. In general, the system includes three workstations; surveying/geodesy/mapping, remote sensing/GIS/LIS, and photogrammetric. The list of all components is shown in table 3 and the overview of this system is presented in figure 2.

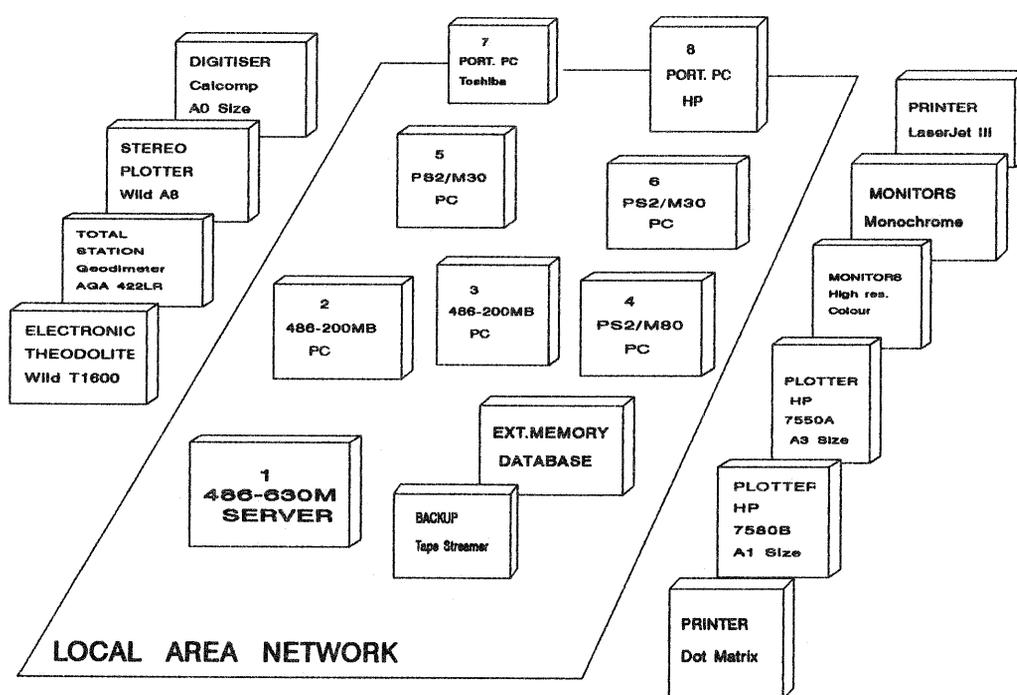
TABLE 3 Components of Integrated Computer System

GROUP OF COMPONENTS	COMPONENTS
COMPUTERS	<ul style="list-style-type: none"> Network of computers with MS DOS Operating System comprises; - one IBM PC PS2/M80 (314 MB HD) - three IBM compatible PC 486- Gateway 2000 (650 MB and 200 MB HD) - three IBM PC PS2/M30 (20 MB HD) - one IBM XT (20 MB HD) - two portable computers (20 MB HD)
INPUT PERIPHERALS	<ul style="list-style-type: none"> - A0 CALCOMP 9100 digitizer - total station GEODIMETER 422 LR - Wild A8 stereoplotter with computer interface - one 500 MB tape streamer to read the remote sensing tapes and store data
OUTPUT PERIPHERALS	<ul style="list-style-type: none"> - three high resolution colour monitors (different size) - HP large size plotter (A1) - HP colour small size plotter (A3) - laser printer, dot matrix printers

table 3 (continuation)

SOFTWARE	<ul style="list-style-type: none"> - local area network LANTASTIC (ARTISOFT, USA) - surveying/geodesy/mapping package GEOSECMA (KORDAB, Sweden) - basic photogrammetric package GEOAIR (NOAP, Sweden) - aerial triangulation PAT MR (INPHO, Germany) - remote sensing/GIS package ILWIS (ITC, the Netherlands) - GIS/LIS package PC ARC INFO (ESRI, USA) - DBASE IV - HARVARD GRAPHICS - WORD PERFECT WP 5.1
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FIGURE 2 The Integrated Computer System at the Department of Surveying, UNZA



In future, each of the workstations will be developed in respect to the available resources. The photogrammetric workstation is very simple because of a limited photogrammetric equipment in the Department. Presently, only the analogous plotter is available. However, there is possibility to extend the photogrammetric workstation within the near future research plans of the Department.

5. TRAINING OF THE STAFF

The process of staff training is very long and expensive. This concerns not only the basic post graduate MSc and PhD courses or technical diploma courses but also the short term courses to refresh or extend a staff knowledge on the new developments in methodology, equipment and software. Training of Zambian staff in the

Department of Surveying, UNZA is sponsored by the external donors SIDA (Sweden) and CICAT (the Netherlands). Presently only two Zambian lecturers assist the Department with teaching, after the completion of the MSc overseas study in fields of Cadastral Surveying and Land Use Planning, Resources Management, respectively. Four other Zambian members are studying PhD and MSc courses in fields of Surveying, Geodesy and Photogrammetry in Stockholm and London. Temporary, four expatriate academic staff from Europe, sponsored by SIDA and CICAT are employed in the Department. Two highly qualified Zambian technicians with the Higher National Diplomas obtained in England and several years experience in surveying and mapping also assist the Department.

Both academic and technical Zambian staff are also involved in short term training (courses, work shops) in the new developments in equipment and software (ILWIS, PC ARC/INFO, PAT MR, GEOSECMA), arranged in Zambia and other countries.

6. REGIONAL COOPERATION IN EDUCATION OF SURVEYORS

The cost of modern surveying education is very high. Such investment can only be reduced through international cooperation within the Region. The countries of Eastern, Central and Southern Africa have only a few academic institutions which can provide a higher education in surveying. The University of Zambia is one of such institutions. Such countries as Botswana, Malawi, Namibia, Swaziland or Mozambique have not higher education in surveying at all.

The Department of Surveying at UNZA is prepared to train up to six students from other countries of the Region each year for the Bachelor Surveying programme. There are two possibilities to enter the Land Surveying programme. Students with only 'O' level education have to study the whole five years programme at UNZA with admission to the first year programme in the School of Natural Sciences. Students with 'A' level or with the technical national diploma in Surveying can be directly admitted to the second year of Engineering programme and subsequently join the Land Surveying programme if they satisfy some other required conditions. The first candidate from Malawi with the technical diploma in Surveying applied for the direct admission to the Engineering programme for 1991/92 academic year but unfortunately he failed the UNZA enter test. The next candidate from Mozambique is expecting to enter the Land Surveying programme through the General Engineering programme in 1992/93.

7. CONCLUSION

Development of African countries requires professional surveyors who are prepared to use the modern technologies in all areas of surveying and mapping. The surveying programme in learning institutions should correspond with technologies presently used and also meet the requirements of new technologies to be introduced in future in these countries. Therefore education of surveyors in African countries requires a very constructive curriculum which takes into consideration all these aspects. A cost of surveying/mapping equipment and application software is very high. Therefore, the choice of equipment should be considered very carefully, keeping in mind the possibility for extension or updating the existing equipment and computer system in the cheapest way.

The academic and technical staff in African learning institutions should have proper basic education and postgraduate training. Therefore, a cooperation and

consolidation of all possible resources and efforts are needed.

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