

# REFRESHER COURSE ON DIGITAL PHOTOGRAMMETRY

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### ABSTRACT

Photogrammetry and Remote Sensing do have their long history. These two mature sciences with their close relationship maintain an important role in the Geo-Information Science. They can provide a better monitoring and management of the Earth surface. Historically, photogrammetric hardware has been changed from analogues to analytical instruments, and now in workstation, which can digitally handle all of the photogrammetric works.

The International Institute for Geo-Information Science and Earth Observation was established in 1950 under the name International Training Center for Aerial Survey (hence ITC). That time at ITC, the photogrammetric subjects were taught, is related to the available analogues instruments. The courses were at the levels of: operators, technicians, postgraduate and M.Sc. But after 1973, the Photogrammetric courses have been integrated into digital mapping techniques, also photogrammetric practical works were at the integrated hybrid and analytical photogrammetric equipments. But the used of those equipments was not for long; rapidly the new digital systems (from PC based to workstation) have appeared. After 1996 the photogrammetric courses at ITC have their new opportunity to exploit on fully digital systems.

ITC realizing the fast development in digital photogrammetry and Remote Sensing is prepared to support its alumni through a refresher course that is also very useful and informative for technologists and technicians in various surveying and mapping organizations that were trained in obsolete methods of map productions. These above-mentioned mean that this course does not offer to only ITC alumni but also prepared to those who learned and practiced photogrammetry elsewhere. It is a short course of two weeks duration.

The objective of this “two weeks refresher course” is to provide the awareness about the technological developments in the field of digital photogrammetry & Remote Sensing and to offer them opportunity to access and to take part (hand-on) in the latest digital photogrammetric workstations. They could be as potential supporters, in relation to the development of digital Photogrammetry and Remote Sensing sciences.

The refresher course includes lectures & practical that this directly leads to the latest developments on: Digital Photogrammetric Systems, Orientations of Images (including Aerial Triangulation), Automatic generations of Digital Terrain Model-Orthophoto-Mosaic, and Feature extraction for the purpose of digital mapping. The quality control of these above processes is also taught.

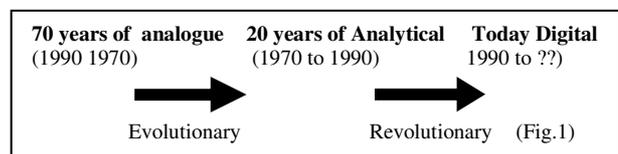
## 1. INTRODUCTION

Regarding to the presences of today digital photogrammetric systems, it is and it will be important to support the mapping techniques with advanced techniques by a refresher course to various surveying and mapping organization and/or institutions. The main concern is to provide the awareness about the new technological developments in the field of digital photogrammetry & Remote Sensing and to offer them opportunity to access and to take part (hand-on) in the latest digital photogrammetric workstations. At the implementing it should include lectures & practical that directly leads to the latest developments about: Digital Photogrammetric Systems, Orientations of Images, automatic Aerial Triangulation, Automatic generation of Digital Terrain Model-Orthophoto-Mosaic, and Feature extraction. The quality control of these above processes will be taken into consideration.

A refresher course on Digital Photogrammetry has been implemented at the ITC's sister institute RECTAS Ile-Ife.

(Nigeria) and the result of implementation are elaborated in the paper.

## 2. REVIEW ABOUT HISTORY & DEVELOPMENTS IN THE FIELD OF PHOTOGRAMMETRY



From the understanding of Fig.1, It is therefore necessary to provide a refresher course in digital photogrammetry to ITC's alumni and/or to technicians in various surveying and mapping organizations, perhaps these peoples were trained (in the past) in obsolete methods related to photogrammetric mapping. A course has been introduced to ITC sister institute “RECTAS” in Nigeria in 2001.

### **3. REFRESHER COURSE IN DIGITAL PHOTOGRAMMETRY FOR GEO-INFORMATION PRODUCTION IN WEST AFRICA.**

#### **3.1 Justification**

Geo-information production processes now have digital components in most of the West African states. RECTAS Council Members (who are the Heads of National Mapping Organizations in the region) confirmed this in May 2000 and urged RECTAS to reflect this in their courses. Need for training in digital photogrammetry was also expressed at the ISPRS congress in Amsterdam in June 2000. Discussions between ITC and Leica confirmed this.

Cost sharing: RECTAS hosted the refresher course and provided infrastructure supporting services (including space, counterpart staffing and some computer equipment) for the course. The contribution from Leica is acknowledged and Leica actively supported this initiative. Both ITC and RECTAS (with ECA affiliations) have input additional resources to ensure the effectiveness of the course, which may be considered additional donor support. The course was given at the Regional Centre for Training in Aerospace Survey "RECTAS" ILE IFE in Nigeria from November 19<sup>th</sup> to November 30<sup>th</sup> by 2 ITC staff members (Sokhon Phem, Karl Grabmaier). There were in total 16 participants (7 Nigerians, 2 Senegalese, 2 Cameroonians, 1 Burkina be, 1 Benin, 1 Niger, 1 Ghanaian and 1 Malian). They were from different background and organisations in which 4 Nigerians from RECTAS, other 3 Nigerians from "Survey department, ICP Leica System, Ministry of Lands & Survey"; 2 Senegalese from "Cadastre department, Travaux Geographic"; 2 Cameroonians from "Min of town planning, Min of urbanism"; 1 Burkina be from DASU; 1 Benin from IGN; 1 Niger from IGN, 1 Ghanaian from survey department. Among those participants there is only one lady from Cameroon.

#### **3.2 About the course**

This course was given in cooperation with RECTAS and LH-Systems that made the software (SOCET SET and Pro600) available and free of charge. The course was intended for 20 participants, and to be given in the last quarter of 2001. More than 20 participants were not feasible with only five available computer systems. It treated typical photogrammetric production on digital photogrammetric systems in a practical manner (Orientation of images including aero triangulation and SPOT orientation, Production of DTMs, Orthophoto and mosaics, editing of DTMs, and digitizing of topographic features). This was done mainly with hands on practical, which were introduced by a short lecture and concluded with a discussion.

#### **3.3 Course objectives (for RECTAS)**

- **Primary objective:**  
To provide awareness of and hands on familiarization with the latest workstation based technological developments in digital photogrammetry for 20 participants (16 regional participants and 4 from RECTAS)
- **Secondary Objectives:**  
Institutional Strengthening: on completion of the course regional staff from NMAS will be aware of the latest technologies and operating procedures and be better able to advise their governments and departments on developments to meet demands for modern digital information. Furthermore the refresher course provided institutional support to the RECTAS

who will be able to reflect the latest technological thinking in its technician, technologist and post-graduate courses.

The refresher course further strengthened the relationship between RECTAS and ITC, which has existed for approximately 30 years. It compliments other activities taking place within the NFP/sister institutes linkage framework. The course also strengthened the RECTAS network with its sustaining partners in the West Africa region. The linkage with Leica strengthened the ITC and RECTAS networks with the private sector. Marketing of ITC expertise and products: the course provided a platform to market ITC products and services to key professionals in 8 West African countries. The refresher course also supports the ongoing commitment to RECTAS in view of the RECTAS/ITC/GDTA CABGLEN proposal currently at ECOWAS/EU.

Potential for developing the refresher course into a commercial course: RECTAS see the potential to develop this course into commercial courses at different levels for technicians, technologists and professionals from Nigeria and the region. Acquisition of non-NFP participants: further extension of support to RECTAS (the ECOWAS/EU initiative) will have a project fellowship component. Cooperation with other donors: refresher courses at RECTAS are coordinated by RECTAS to meet regional needs. There will be short courses run at RECTAS in 2001 with support from French bilateral assistance.

#### **3.4 Content of the course**

- Introduction to the course and to the hardware and software used
- Project Setup and Import of data
- Digital Orientation and Aero-triangulation
- Automatic DTM and Orthophoto production
- Feature Extraction
- Final discussion about digital photogrammetric systems and future outlook.

### **4. RECRUITMENT & SELECTION**

One of the 20 places was granted to a participant to be nominated by the local representative of LH-Systems in consideration of the software being made available free of charge.

Recruitment and selection was further done by RECTAS according to guidelines from ITC and with the help of alumni lists provided by ITC. 20 participants (of which one was nominated by the local representative of LH-Systems) were selected, but 4 of them did actually not come to the course.

### **5. EXECUTION OF THE COURSE**

On Nov. 13<sup>th</sup> we left Enschede with 5 stereo shutters, a laptop PC and a LCD-projector in our luggage and fetched additional electronic components for the stereo-shutters on our way to Amsterdam. Nov. 14<sup>th</sup> we flew from Amsterdam to Lagos. We had approximately 75 kg of luggage, with 20 kg allowance each (thus together 40 kg) but managed to pay for only 16 kg of excess luggage. Mr. Lartey from RECTAS took care of all formalities regarding our luggage. In Lagos we stayed overnight, then arrangements for some course participants had to be made locally before we could leave for Ile-Ife.

Local preparations had to start with the installation of the hardware (fitting of the stereo shutters) and software (SOCET SET, PRO600 etc.), and changing the course material to the local situation. At our arrival the computer systems had not yet been installed, so we started to change the course-material according to the intended hard- and software configuration.

There was no license available for Microstation, so we did not install Pro600, but changed the feature extraction exercise for the available “Feature”-module. As we were not familiar with this module, we had to learn about it and then adapt the course material for it. We spent all Saturday and Sunday to help with the installation of the computer systems, install the Photogrammetric software and the data needed for the course and fit the stereo shutters to the monitors.

Due to an error in the license file of the software the preparations could not be completed by Sunday evening. On Monday morning help from the software vendor came very prompt and precise, which allowed us to start the course on Monday after the lunch break.

Language turned out to be a problem. As half of the member states supporting RECTAS are francophone, there were some course participant unfit to follow the course in English language. It was impossible to translate all the course material to French, especially as we had to spend a lot of time to adapt the English material to the local configuration and the different release of the software. To overcome the language problem the course was given in the following way:

- Course material was provided only in English;
- Introductory lectures and discussions were bilingual (i.e. everything was said in 2 languages, every contribution of course participants was first translated to the other language and then a reaction was given in both languages);
- Exercise groups were formed such, that there were 2 English groups, one bilingual group and 2 French groups. Each one of the French groups had one very well bilingual group member in order to support the non-English speaking group members.

We managed to stay ahead of the program with the adaptation of the material, although the assistance of both staff members was needed throughout all exercises. Many lunch breaks, evening hours and half the second weekend had to be sacrificed for this goal.

On the last day a course evaluation by the participants was held (by Rectas staff in order not to influence the participants with our presence), then a closing ceremony was held in which the director and the deputy director of RECTAS together with the two staff members of ITC handed a bilingual “Certificate of Participation” to each participant. The directorate of RECTAS also handed a “Certificate of Appreciation” to each of the staff members of ITC. The day was concluded with a dinner of all participants and all involved staff.

### Remark

Each part was started with an introduction and/or a small background lecture. The material (only in English!) was given in print to the participants and also projected on a screen while explanations were given in both languages. Hands on exercises were carried out in groups of three or four course participants, with assistance by two staff members constantly available. Each part was concluded with a (bilingual) discussion. Projection of lecture material was used when appropriate for clarifications in those discussions. Also during the practical the CCD-projector was used for support.

During part of one session the local representative of the software vendor (Mr. Greuter) was available for a discussion about the software used (SOCET SET from LH-Systems).

The executed timetable was.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Time	19-11	20-11	21-11	22-11	23-11
9:00-10:30		Preparations for orientation	Demo+hands-on Image enhancement	Continuation orientation of a model	Demo SPOT Orientation
10:45-12:15		Orientation of a single image	Continuation Image Enhancement	Continuation orientation of a model	Aero-triangulation
14:15-15:45	General Introduction	Continuation single image	Orientation of a model	Continuation orientation of a model	Continuation of AT
16:00-17:30	Introduction to SocetSet	Continuation single image	Continuation orientation of a model	Discussion orientation	Continuation of AT

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Time	26-11	27-11	28-11	29-11	30-11
9:00-10:30	Continuation of AT	Discussion AT	Continuation of Mosaicing	Continuation DTM editing	Topics of participants choice
10:45-12:15	Continuation of AT	Intro Orthophoto	Intro DTM & image matching	Discussion DTM-ortho + Greuter	Discussion digital photogrammetry
14:15-15:45	Continuation of AT	Orthophoto generation	DTM assessment and editing	Demo feature extraction	Evaluation of the course
16:00-17:30	Continuation of AT	Orthophoto and mosaicing	Continuation of DTM editing	Exercise feature extraction	Closing of the course

## 6. EVALUATION & RECOMMENDATION (MADE BY RECTAS & BY ITC STAFF)

### 6.1. A successful evaluation by “rectas” Nigeria

After an introduction of a refresher course in digital photogrammetry at RECTAS “Ile-Ife, Nigeria”, a positive feedback “through an evaluation” [reported to ITC from RECTAS] has been received “including participant from 8 ECA-member states (mix of Francophone and English speaking in West Africa: Nigeria, Ghana, Cameroon, Mali, Senegal, Niger, Burkina Faso and Benin). From RECTAS staff and from

participants evaluation stated that such a refresher course is very much demanding at their organization. The participants were extremely motivated and many spent more time on the systems than allotted. Some even spent part of the weekend to repeat parts they were not sure enough of.

### 6.2 Individual assessment made by RECTAS together with course participants

Practically all the participants remarked that the course was just right and that it has helped to open their eyes to new techniques in photogrammetry through the training they got from this

Digital Photogrammetry refresher course. All of the participants said the programme is worth mentioning to their colleagues and would advise them to participate in similar training in the future. Some even suggested that decision makers should be sensitised so as to draw their attention to this new technology in photogrammetry.

According to the assessment of some of the participants, some shortcomings were apparent, these were:

- Short time of the course duration as many believed that such programme should have lasted for a little longer - say 4 weeks at least, for them to be able to master it very well.
- Cost (in 2001) of the software - \$70,000.00! an amount which they think may be rather high for the African environment. The suggestion offered is that software less costly may encourage many buyers.
- Ratio of participants to computer system is reduced to say, 1 system to 2 trainees.
- Training materials for practical should be from the immediate environment to make participants familiar with the terrain thereby making the training more real than virtual.
- Software written in French also is solicited for the francophone.

### 6.3 Assessment made by ITC staff members

For the evaluation of the course by the participants English and a French version of a questionnaire was given to the participants to be filled in. All participants took part in the evaluation and there were 7 English and 9 French forms handed in. In total the result was very positive. In the annex the English form is included as well as a summary of the answers

Giving the course was very demanding, (a lot of free time had to be sacrificed to do it properly), but also very rewarding. The participants were extremely motivated and many spent more time on the systems than allotted. Some even spent part of the weekend to repeat parts they were not sure enough of. It is highly recommendable to give such a course to different groups (in different parts of the world or perhaps at the ITC, where occasionally up to 50 participants could be accommodated), as there is definitely a need for it. Bilingual groups should however be avoided. The need and the feasibility of translating the material and giving the course in other languages than English (e.g. French or Spanish) should be investigated.

## 7. CONCLUSION

As mentioned about a refresher course ran at RECTAS Nigeria, the course was a very useful and very successful one; to be able to support mapping techniques and/or operations (at various organizations and/or institution), this type of support should be organized. Many participants urged ITC to contribute to the awareness of this technology at the political level (only then sufficient funds will be available to make the switch in near future). Basically this course could be used for this purpose with some modifications, such that the duration is reduced to a single week and hands on practices are reduced considerably and/or substituted by demonstrations. Background lectures and discussions will have to occupy more time for this scenario.

Evaluation form has been distributed to participants (see results below), to contribute their degree of satisfaction about the: Content, Lecture & Practical, material & organization of the course rating from 1 to 4:

(1 = Strongly disagree; 2 = Disagree; 3 = Agree; 4 = Strongly agree)

<b>Course contents</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>(No answer)</b>
I acquired many valuable skills	0	0	9	6	1
I acquired much valuable Information	0	0	7	8	1
The content & scope met my expectation	0	0	13	3	0
The course was offered at the right level	0	0	13	3	0
<b>Classes</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>(No answer)</b>
Enough room for questions/remarks?	0	0	2	14	0
Practical were well prepared/organized?	0	1	9	6	0
Background information was given too much?	15	say "Just right"			1
<b>Materials &amp; organization</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>(No answer)</b>
Materials used in practical were adequate?	0	0	7	8	1
The teaching staff reacted adequately to any comments?	0	0	4	12	0
The level of teaching staff was adequately?	0	0	8	8	0
The computers system were adequate for the course?	0	0	9	7	0
Stereo observation/equipment was essential for the execution of the course?	0	0	5	11	0
The software used is user friendly?	0	1	12	3	0

## 8. REFERENCES

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