

## PHOTOGRAMMETRY AND REMOTE SENSING TRAINING FOR CADASTRAL STAFF IN CENTRAL AMERICA

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### ABSTRACT:

An audit conducted by the French consortium FIEF-SOFRECO has been undertaken in Guatemala, Nicaragua, El Salvador, Honduras, Costa Rica and Panama, in order to identify local resources in terms of academic training for cadastral staff. This audit was funded by the World Bank and USAID, and its results were presented in a workshop held in Guatemala in November 2001. In this paper, the situation of Central America in terms of land administration is recalled and the limitations of the training system are analysed. The case of technical curricula, e.g. photogrammetry and remote sensing, is specifically considered and the new technical curricula proposed for technical staff and for trainees are presented.

### 1. INTRODUCTION

A few years ago, land administration was identified as a priority for Central America, and dedicated programmes were funded by the World Bank and cooperation agencies such as USAID. However, several initiatives were jeopardized by the lack of skilled people in the technical and legal fields related to land administration.

In this context, a survey was funded by the World Bank and USAID and supported by the French Ministry of Foreign Affairs, to identify regional needs and existing resources in the field of cadastral staff training. This survey was conducted by the French consortium FIEF-SOFRECO and several experts from France and Central America were involved. Technical, administrative and legal training fields were considered together.

In this paper, the regional context of land administration is recalled. The objectives and results of this survey are presented and the case of technical curricula is considered. Finally, the programme designed for photogrammetry and remote sensing is described.

### 2. BACKGROUND

The cadastral system in Central America is different from country to country. Land reforms have taken place, as in Costa

Rica, and procedures for land redistribution together with new cadastre have been implemented in Guatemala in the framework of the recent peace agreements. Large cadastral operations have also affected Honduras and Nicaragua. El Salvador is one of the most advanced countries in the field of low rent housing projects and this policy has led to a national programme for the modernisation of the cadastral system and its registry.

In addition, the recent history of these now pacified countries justifies investments in every areas of land management: planning, urbanism, hydraulic, road infrastructure and the necessary cadastre system.

The countries of Central America are endowed with personnel well qualified in traditional topography. However, they suffer from an obvious lack of highly qualified staff in the related fields such as geodesy, photogrammetry, computer science and geographical information systems. In addition, it is necessary that civil servants get a complementary specialisation in the field of cadastre and all areas of land management.

An international seminar held in November 2000 in El Salvador on “training as key element for the quality and sustainability of land administration projects” established the first basis for new thinking on the above problems. It resulted in the need for a regional audit of Central American Training Programs and Education Resources for Land Administration Programs.

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Figure 1: Central America

### 3. REGIONAL NEEDS AND RESOURCES

The audit of regional needs and resources was funded by the World Bank and USAID and conducted by the French consortium FIEF-SOFRECO, in order to identify regional needs and existing resources in the field of cadastral staff training. This survey was carried out in 2001. Meetings were organized in the 6 countries (see map on figure 1) with land administration decision makers and academic institutions in order to analyse the adequacy between the training potential of these countries and their requirements.

A quality assessment of existing training activities was proposed, based on several criteria.

- ◆ assessment of capacities of the trained people ;
- ◆ assessment of the trainers' skills ;
- ◆ appropriateness of subjects taught to the final users' needs ;
- ◆ appropriateness of the number of trainees at each level (technicians, surveyors, officers, engineers, etc.) to the needs ;
- ◆ balance between theoretical and practical training : are the people trained immediately operational ?
- ◆ links between the final users and training entities: participation of officers from the land administrations in drafting training programmes, participation in training.

The results of the audit were presented in a workshop held in Antigua (Guatemala) in November 2001, in the presence of decision makers from the 6 countries and the funding organizations (mainly the World Bank and USAID as well as the cooperation agencies of several European countries). It clearly appeared that the academic curricula of each country are not adapted to the urgent needs in the field of land administration.

### 4. THE CASE OF GEOMATICS CURRICULA

It seems that the situation is even more serious in the field of photogrammetry, remote sensing and other geographical techniques. Very few trainees are available in these fields. Moreover, the technical curricula suffer from a lack of prestige in Central America, and many students would rather study law than become engineers.

Among the fields in which cadastral technicians require training, photogrammetry and remote sensing play a key role due to the multiple use of these techniques for land use planning :

- land cover information updating ;
- spatial analysis for land management ;
- land occupation evidence (i.e. visual proof) ;
- image-based communication and negotiation.

Airborne or spaceborne imagery is a very promising communication tool between people with no technical background. This is particularly relevant in Central America where the rate of illiteracy ranges from 5 to more than 30%. Therefore, the trainees must be able to understand and handle remote sensing products as soon as they are in contact with local population.

The French college ESGT (Ecole Supérieure des Géomètres et Topographes), where 80 topographic engineers are trained every year, was invited to bring its know-how and to contribute to the design of future training programmes in Central America.

Training programmes in the field of photogrammetry and remote sensing were proposed and discussed. Two levels were considered :

- ◆ technical staff (*capacitación técnica*) ;
- ◆ academic staff in charge of technical education and training (*capacitación de capacitadores*).

### 5. TRAINING PROGRAMMES PROPOSED FOR PHOTOGRAMMETRY AND REMOTE SENSING

#### 5.1. Technical staff training

A training session called “**percepción remota y cartografía digital : principios y aplicaciones catastrales**” was organized in November 2001 in Guatemala City. About 20 technicians from IGN (national mapping agency) and from the cadastral administration attended a 3 day course on both theoretical and practical aspects of airborne and spaceborne imagery, orthorectification techniques, digital elevation modelling, etc.

Not only technical aspects but also industrial ones were stressed :

- ◆ market organization ;
- ◆ geometric and radiometric criteria ;
- ◆ quality assessment methodology.

This should provide the cadastral staff with suitable knowledge and method when they import products or services for foreign providers.

The quality of the course and its adequacy with the national and regional needs of land administration were evaluated after the course in the frame of an open discussion.

## 5.2. Academic staff training

A training session dedicated to people in charge of training has been planned for October 2002. Its main objectives are to :

- ◆ refresh technical skill in the field of photogrammetry and remote sensing and their cadastral applications ;
- ◆ propose suitable training methods ;
- ◆ provide pedagogical documentation.

It is dedicated to people having an engineering degree or equivalent, mostly in the academic sector, preferably having the opportunity to teach in the following months in one of the 6 countries. The programme is sized for 1 week and divided into 5 sections :

1. course on the mathematical and physical basis of photogrammetry and remote sensing : orbital physics, spectral

signatures, sensor characteristics, radiometrical and geometrical properties of satellite and aerial images.

2. course on digital image processing techniques : image enhancement, orthorectification and mosaicking, feature extraction.

3. course on the industrial context : observation system design, market of products, tools and services, industrial and financial organization of the end users' communities, quality assessment, industrial trends.

4. pedagogical engineering : objectives of main training levels, discussion of theoretical and practical difficulties to be faced in remote sensing training, discussion of existing training tools and methods with regards to the addressed teaching level.

5. Focus on regional difficulties : geographical and geopolitical characterization of Central America and impact on the selection of technical solutions, recommendations for the design of training programmes in the field of photogrammetry and remote sensing.

## 6. ACKNOWLEDGEMENT

The training projects described in this paper are based on the result on the audit conducted by the French consortium FIEF-SOFRECO and funded by the World Bank and USAID, and the training method is based on the know-how developed at ESGT (Le Mans, France). The travelling costs of the remote sensing sessions are covered by the French Ministry of Foreign Affairs.