

THE MAPPING PRODUCTION IN COLOMBIA: TOWARDS THE CREATION OF TOPOGRAPHIC DATABASES

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ABSTRACT.

The Instituto Geográfico Agustín Codazzi, in charge of the colombian agrolgy, cartography, cadastre and geography, is developing its Technological Modernization Programme in order to improve the productivity and the flexibility of its products and, therefore, attend the needs of its clients.

The new cartographic production of IGAC is oriented to the creation and maintenance of topographic databases useful as foundation for the Geographical Information Systems.

Its current photogrammetric, geodetic and GIS equipments have been integrate into a production system which is going on since August 1994. Its actual performance, its advantages and limitations are discussed here.

IGAC's expectations of the near future are explained.

1. INTRODUCTION

The Instituto Geográfico Agustín Codazzi (IGAC) is the governmental agency which is responsible for the production of topographic maps at different scales to support the main activities of territorial ordering and planning.

Since its foundation in 1935, IGAC performs its map compilation photogrammetrically. Its maps vary in scale: 1:100.000 for the entire territory, 1:25.000 and 1:10.000 for the developed rural area and 1:2.000 for the most important cities.

An evaluation of the IGAC's activities reported in 1992, showed that the compiled maps covered a high percent of the nation but they had become old: more than 50% had been issued earlier than 1980. In addition, it become clear that the biggest obstacle to the aerial photos needed to develop the topographic mapping program was the permanent presence of clouds and fog over the andean territory.

2. THE MODERNIZATION PROGRAMME

The mentioned report pushed the Technological Modernization Programme, an institutional effort defined since 1990 with the aim to improve the quantity and the quality of the IGAC's products to fulfill the growing user's requirements.

IGAC started in 1992 its actions to access to the new developments in photogrammetry, geodesy, GIS, and other related areas. Its departments, Agrolgy, Cartography,

Cadastre and Geography used to work with obsolete equipment and manual procedures. The slow productivity and flexibility claimed for change.

3. THE TOOLS

IGAC designed and implemented a new mapping production process. It uses modern technology in order to carry out the different tasks:

- Acquisition of aerial photography. An aerial camera system WILD RC 30 replaces old equipment.
- Ground Control. IGAC uses for the geodetic measurement of the control points GPS receivers WILD DSR99 (20), distancemeters DI3000 (2), distancemeters 2000 (1), geodetic levels N3 (4), automatic levels NAK2 (2), electronic theodolite T2002 (2), electronic tacheometers TC1610 (4) and electronic distancemeters DI2002 (1).
- Aerotriangulation and Restitution. It is done on workstations VAX 4000-90/60 connected to the upgraded analog plotters (7) and the analyticals plotters DSR15 and SD2000 (5).
- Editing and graphic outputs. This work is done with workstations VAX 4000-60 (30) and digitizers CALCOMP 95480 y 95482, flat-bed plotters WILD TA10 (4) and drum plotters CALCOMP 1044 GT.

The INFOCAM/ORACLE software running with the VMS operating system, enables the overall mapping production,

including the data collection, the geometric correction, the structuring, the editing and the drawing.

In order to assure the integrity of the information, a local network Ethernet connecting six nodes was installed. Each node is doted with database servers (the total storage capacity is 76 gygabytes). The operating system is managed by a central server VAX 4000-400, Double System, 160 MB RAM per each one, with peripherals devices for reading, storage and printing.

4. THE BASIC TASKS

The new mapping production includes until now the 1:2.000, 1:10.000 and 1:25.000 scales. The conceptual framework inherent to the digital cartography focus the attention to the construction of the data infrastructure required for the different users to the implementation of Geographic Information Systems. They need, by definition, reliable, high quality, current and topologically structured data, organized in a flexible model.

Hence, IGAC defined as the core of its function the creation and maintenance of the national topographic database. Cartographer's thoughts were changed because of the technology and the client's needs.

Both, the implementation of the new production flow and the creation of the data base started in August, 1994, after developing some basic activities:

1. Analysis of user's requirements and definition of the modernization guidelines.
2. Design of the basic components and the technical specifications of the new system.
3. Acquisition, installation and testing of the equipment.
4. Training.
5. Design of the IGAC database (data organization and data structure).
6. Definition of the methodologies and procedures for the new topographic and thematic mapping production and for the digitizing of the analog cartography.
7. Testing of the new production flow in a pilot project.

5. THE DATA MODEL

IGAC has defined a digital data model that includes the whole objects or features needed in the different departments to elaborate their products. Thus, each technical area adds (or integrates) its own data (or attributes) over the topographic data which act as a basic framework.

It was defined an unique feature's classification system, that divides the universe into classes or themes, which are

divided, again, into groups. For each scale, it was selected the list of objects relevant to each group, described its geometry and attributes, identified its relationships and defined its sources, collection and processing rules and representation standards.

6. THE WORKFLOW

The current IGAC's photogrammetric production line is as follows:

- Definition of the data model
- Creation of the project (scale, coverage, inputs, topology rules)
- Establishment of the different access levels
- Users definition.
- Preparation of the project (model orientation, creation of extracts and local storage units).
- Restitution (3D data collection)
- Topology Building and on-line editing
- Geometric and logic correction of elements
- Attributes adition
- Preparation of graphic outputs
- Final Printing
- Storage in the data base

This workflow is done in two different groups - Restitution and Editing - and involves some quality check points (and plots) including the final position's accuracy test.

7. THE RESULTS

One and a half year after going on with the new system, it is clear that the current maps are different. Their quality and usefulness are without any doubt better than the previous. The photogrammetric and cartographic work is no more the same. It may be more exigent but indeed more gratifying.

The IGAC database has started to be feed. IGAC joins its own capacity and also put work out to contract with private companies to accelerate the process. The main achievement has been the production of seamless digital maps of eleven cities (600 km²) at 1:2.000 scale. Those cities majors have obtained the digital framework required to accomplish their management and planning activities. The completion, maintenance and updating of the topographic database are now the duty. Several tools will help IGAC to do it efficiently: the super-imposition modules, both stereoscopic and monoscopic, offered by the new system.

The IGAC productivity is, nowadays, lower than the obtained with the traditional mapping flow. It seems influenced by the following factors:

1. The work is much more complex now.
2. The people's accomodation to the changes are no so fast as you want it.

3. The performance of the various devices or modules is not longer the same in a production line than in a single practice.
4. The amount of the stored data in the relational database -available for different applications- affects the system's response time.

The advantages and the limitations of the current mapping process are clear. Some problems arose with the new production remain unsolved and require a lot of research to define clearly the way to break them out. The production of the scale 1:100.000 maps is done following an ancient procedure that includes both manual generalization, scribing and photographic colour separation.

8. THE NEAR FUTURE

IGAC has started recently what is called its second phase of modernization in order to:

1. Improving the performance of the overall system.
2. Rupture of the existing bottlenecks in the production flow.
3. Definition and testing of alternative methods to the production and updating of topographic maps (using and integrating different metric sensors, photographics and no photographics, obtained from aerial and satellite platforms).
4. Research in map generalization to apply in the production of 1:100.000 scale.
5. Integration of raster/vector data in the mapping production.

The digital photogrammetry offers attractive possibilities to dinamize the mapping production and IGAC has taken its option in that way. It has started a preliminar project using a Digital Photogrammetric Helava Station which enables to process imagery from different sources (radar among them). The project results must clarify the advantages -and also the limitations- of the new tools and define the most suitable application lines for the Colombian needs. IGAC hopes that the big dream of the colombian cartographers, no one cartographic hole in the nation, become reality in the next century.

9. CONCLUSIONS

The last decade developments in photogrammetry and remote sensing are helping mapping agencies, including IGAC, to improve their work which is directed to create, maintain and update topographic databases. It's clear that the potencial of the latest technology must be strongly tested before it become a production standard.

The successful implementation of a new mapping production system may be a real fact only by assuring the coexistence of three critical factors:

1. A head organization aware of the need of the change and its complexity.
2. A highly qualified and engaged elite force.
3. A strategic plan leading the way.

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