PRODUCTION DIGITAL MAPPING FLOWCHARTING EXPERIENCES IN CHILE USING MGE MAP PUBLISHER

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ABSTRACT

For the conversion from traditional to digital mapping, the Chilean institution responsible for national map production, The Military Geographic Institute, has implemented a new cartographic production system. For this reason it is necessary to develop an appropriate organization of the work flow and in this way to have access to the management of digital processes. The main objective is to achieve a high quality standard in production and in map updating. The flow chart designed is under constant evaluation in order to make the necessary improvements in the entire mapping process. The main benefit obtained makes it possible for the whole organization, from manager to operator, to understand the new mapping system, to strictly follow technical mapping procedures and in this way to reach national digital cartographic standards.

Introduction

The making of cartographic material has been influenced by technology in which pen and paper have been replaced by the computer and the theodolite by the satellite.

In view of such fast developments, the Military Geographic Institute as the official authority regarding Geography, topographic measurement and charts, has been taking steps in order to develop the area of "Digital Cartography" which is the first link for a later development of Geographical Information Systems.

The main objective of the Military Geographic Institute is to establish the graphic representation of our national territory, research and other field and office-based work being carried out to these ends. The field work is for obtaining coordinate values and elevation points and the office work is for planning, photogrammetric restitution and cartographic drawing, the latter being our main concern.

The National Cartography and Photogrammetric Plan is a landmark in the history of our Military Geographic Institute trough modernizing its infrastructure, just as was the updating of our photogrammetric and cartographic equipment through the introduction of new office and field work systems and a substantial training abroad of our personnel .

This project has made it possible to cover 97% of the country with Regular Cartography at 1:50.000, 1:250.000 and 1:500 scales and in some areas regular cartography at a 1:25.000 scale.

The analogue regular cartography was obtained mainly by the stabilene, color division of the document based on information drawn from photogrametric restitution and then the printing of original documents.

In 1990 in accordance with the new technology and the needs of the country, a plan for modernizing and automating the productive process was started, aimed at the production of digital cartography. The GEOTEC project was thus started and the Military Geographic Institute is responsible for updating Digital Cartography at the 1:50,000, 1:250,000 and 1:500,000 scales.

This Digital Cartography can be used :
- As a base for Geographical Information Systems (Civil and Military)
- The making of digital land models
- Base documents for Offset prints
- The availability of a digital product according to new technology.

GENERAL DESCRIPTION OF THE PROCESS

Having a clear view of the Institute's mission and having a complete coverage of the Regular Cartography at different scales and considering the great technological advances, the Military Geography Institute can now concentrate on the production of Digital Cartography based on Regular Cartography.

Digital cartography has the same technical characteristics as the analogue one (projection, ellipsoid, equidistance, etc.). The main objective is to transform the graphic information on paper to a digital format under a Thematic and Rational Data Base and to keep it updated through digital processes. The files can be manipulated in a computer, specialized hardware and software thus allowing an easy handling of the information. (Base for G.I.S).

The information is obtained through the stabilene process used in Analogue Cartography which once taken to photographic paper has five graphic outputs : Hydrographic, planimetry, orography, vegetation and text.

The outlets are scanned in Cit format (raster) and then georeferenced to start the vectorisation process or the capture of all the linear , point and areal objects.

A regular chart is made up of different levels of information where each one is a file. This corresponds to the organization of a cartographic data base at a 1:50.000 scale and which has 13 levels or thematic categories:
- Drainage
- Elevation
- Vegetation (vg)
- Roads (rd)
- Railroads (rr)
- Industry (in)

- Physiography (py)
- Borders (bd)
- Coast (co)
- Cultural
- Text (tx)
- Aeronautic (ae)
- 3D

This digital process allows the editing and modifying of the stored information at any time. Depending on the scale, all the Regular Cartography made by the Military Geographic Institute has the same structure.

Today there is a high percentage of the country covered by Digital Cartography which is done in the Intergraph environment and can be obtained in any of the following formats : DGN, DWG, EOO, SHAPEFILE, DXF, for either digital or graphic printing (obtaining base documents for offset printing).

EQUIPMENT USED

Through the use of state of the art technology and equipment and highly qualified personnel, the Military Geographic Institute is a modern and efficient institution, able to develop cartographic products at the highest standards.

The following equipment was used for the modernization plan as well as the making of Digital Cartography:

HARDWARE
- 12 TD-30 work stations
- 3 TD-220 work stations
- 3 TD-Z work stations.
- 2 publishing stations
- 1 photoplotter-scann Map-setter (for Print Positives)
- 1 Silicon Graphic station (file transformation)
- 1Eagle Scanner
- 1 Iris Plotter 3047
 - 2 Process stations for UNIX environment.
The above list is all Integraph equipment

SOFTWARE
- Microstation
- I/Geovec /MSCC
- Ris
- Infomix
- Iras- C
- Unix
-   Smith Scanner

DETAILED PROCESS

A) PLANNING
The work areas must be defined in this stage, determining the necessary information about the Geocartographic data to be used, as well as production control.

B) DATA BASE CREATION / RIS SCHEME AND MGE PROJECT

The first two tasks correspond to the creation of a work zone, indicating Datum, UTM zone, UTM coordinates, etc. as well as the table used for the vectorization.

The creation of the MGE Project is carried out a Windows NT environment, directing the corresponding Data Base (RIS) to two process stations with UNIX environment.

C) INFORMATION PREPARATION / DOCUMENT INPUT

The traditional cartography in our country is done mostly in stabilene and colour separation and these are the base documents. In order to obtain the final documents and using the Category concept, the information is grouped as follows :
- Text
- Vegetation - Green
- Orography- Brown
- Planimetry- Black
- Hydrographic - Blue.

The documents thus obtained are five in number and are all blended on photographic paper. In the scanner station and using the Software Scanner Smith and the Windows NT environment, the Rastering of the five combined documents is carried out. This rastering consists of the transformation of the five blended elements in a CIT binary format file with a 500 DPI resolution.

The corner matching and the perfect location of the raster allow for a good georeference.

D) RASTER TO VECTOR CONVERSION

This is the base stage and the quality of the final product will depend on the accuracy with which it is done, the fidelity of the digitized data, the importance given to the capture of the originals and their georeferencing.

SUB- STAGES
- Georeferencing of Raster files.

This stage is done under Windows NT environment, in IRASB software; with the corresponding parameters, the WARP (Scale) function admits standard errors, at or close to 5m. (for the 1:50.000 scale).

- Vectorisation
Organization of the working environment.
The environment, along with using the Integraph system platform- Micro Station, uses the Geovec, MSFC IKAS B application Software.

This corresponds to the screen digitization of all the information in raster format so that the raster cells or pixels are transformed into vectors which are stored in different levels of information and with characteristics of colors, width and size. The digitization is also done with MSFC tools using the Feature Table (TLM. TBL) and thus each element is labeled according to its corresponding code.

A linear element for example:
Gully, code L-G 11 represented as a line
A point element:
House, code P-305, represented as shells.

An areal element:
Lake, code P-305 for the perimeter, A-604 from the lake center.

There are two more vectorisation types, the semiautomatic done through the IGEOVEC tools conditioned by the quantity and quality of the raster file information and the automatic vectorisation done with the IVEL software, usually used to digitize the orography in a quick and precise way.
Once all the information in the raster file has been vectorised the Plotting stage come after.

E) PLOTTING / CHECKING

The file is merged with a copy of the grid file in order to plot out a to-scale copy, so that the Checking and Quality Control section can make the corresponding checks.

F) DATA BASE INPUT

Once the approval of the Quality Control section is obtained, the thematic categories construction process is started. A maximum of 13 files or categories complements the chart depending on the area or sector of the country being represented.

The captured elements will be included in the Data Base according to types.
Bull-loader under UNIX environment.
Load Feature Into MGE under Windows NT.

Using the MGE Software, the separation of categories is done through the Load Feature. Using the project, the seed and the corresponding table, the process that will produce as

many files as categories selected from the Feature Table, is carried out. It will also create a IDX file , an index between the data base and the graphic elements.

G) "FILE CLEANING" PROCESS

In order to carry out this process under the Windows NT, MGE environment, it is necessary to activate:
- Duplicate Line Processor
- Intersection Processor
Under an acceptable tolerance for the working scale.

H) RE-SYMBOLIZATION

This consists of the symbolization of the vectorial data according to their categories. This is done under Windows NT, MGE, Base Mapper Tools.
Resymbolise.

I) MAP FINISHER INTERMEDIATE PROCESS.

This process determines the product areas on the basis of the centroids captured in the digitizing.

J) DIGITAL CHART

Once all the categories have been obtained, one last on-screen check is done in order to detect any remaining mistakes.

K) GRAPHIC OUTPUT

There are five stages in the production of the impression positives.
1) Data Preparation (symbolization)
2) Rastering
3) Lithographic Process
4) Color Test
5) Film Creation

1) Data Preparation
The vector data preparation implies their organization and symbolization. The data must be set apart and processed before being rasterized. The files used are Integraph files which contain the Map Finisher process and their corresponding FTP which contains all the Data Base.

2) Rasterization
Nowadays, all output equipment, either printers or plotters, work with the raster format.
It is therefore necessary to rasterize all the DGN files.

The DGN symbols must be converted to the final symbols required in the map, the rasterization of all symbology categories required for the design file must therefore be done. A RLE file is generated for each of the symbology categories. Once the process of creating RLE's is finished comes the stage of working with MAP PUBLISHER, which makes the color division, orthophotos, image maps and collage.

3) Lithographic Processing
The program is made up of 4 main modules.

1. Photo Lab   2. Image Plot   3. Photoplot   4. Collage.

All these files work with 2 important files:
-Specification tables : Specification tables for grids, colors, patterns, font
-Path File : Path for the files on the Specification Table.

The module used to generate scale digital charts is Photo Lab 3 which has the following characteristics::
- Generates the separation of colors for all files at once.
- Generates a CRL File (obtention file) for color tests (Plotter Iris).
- It has the preview option which allows for the generation of a preliminary display file.
- Accepts only RLE files as input.
- Accepts input files only with the same size and resolution.

The output of Photo Lab 3 are the raster files which include instructions for film plotting with digital, lithographic, grid and-or pattern applications.

The output files are ordered according to the priorities assigned for printing and the way to mask if necessary.

The CRL file is generated and then plotted in IRIS3047 for checking, next the digital files are generated for plotting in Map setter films through SIRF software and then printed.

PRESENT PRODUCTION

The present development of the digital cartography at the IGM allows us to have practically all our territory digitized, covering up to 96.78% of its total extent. Efforts are now centered on the updating of the cartography already digitized and on the graphic output. The figures we can show as of March 39th 20001 are the following:

Product	Number of Pages	Finished Pages	Pages in Process	Pending	Without Photogram metric cover
Vectorisation 1:50.000	1272	1233	0	39	39
Vectorisation 1:100.000	53	34	11	8	8
Vectorisation 1:250.000	75	66	4	5	5
Vectorisation 1:500.000	22	17	2	5	3
Updating 1:50.000	1272	794	179	299	67