

## EXPERIENCE OF THE MILITARY GEOGRAPHIC INSTITUTE OF CHILE IN THE NATIONAL INFRASTRUCTURE FOR GEOSPATIAL DATA.

Rodrigo Barriga V.<sup>1</sup>  
Maria Loreto Advis N.<sup>2</sup>  
Military Geographic Institute  
Nueva Santa Isabel 1640, Santiago, Chile

### 1. INTRODUCTION

The Military Geographic Institute of Chile (IGM) was founded in the year 1922. Since that date it has been the 'official body', representing the State of Chile, responsible for establishing the basic geographic information covering Chilean Territory.

Since its creation the IGM has created various types of cartographic information covering the whole of the country, this being at different scales and 99 % of which is in digital format. The regular cartography at 1:50,000 scale is the basis for the development of other cartographic coverage at smaller scales (1:250,000 and 1:500.000). Moreover, urban digital cartography has also been developed (1:1,000 to 1:5,000) for a significant number of the cities in Chilean territory.

The creation of the digital cartographic information at 1:50,000 was achieved taking advantage of the previously existing and highly useful analogue-format data, the new structure at the same time following an adaptation of the conventional standards proposed by the PanAmerican Institute for Geography and History (IPGH) and in accordance with the recommendations of the NIMA.

Currently the IGM is working at an ever-increasing pace on the optimization of this digital cartographic information by means of a process of checking and verifying the data contained in the cartography, in order to prepare it appropriately, both for processes related to its use in Geographic Information Systems and for publication and printing.

In addition to its efforts to create an adequate geodesic and cartographic set of information, the IGM is constantly cooperating with various initiatives both at national and international levels, by means of its contribution to basic geospatial data. At a national level there is adequate cooperation with other organisations possessing similar characteristics, such as the Hydrographic and Oceanographic Service of the Navy<sup>3</sup>, the Aerophotogrammetric Service of the Air Force<sup>4</sup> and the Center for Natural Resources Research<sup>5</sup>.

#### **Projects Performed by the IGM :**

The following plan sets out a simplified overview of the most relevant projects performed by the Military Geographic Institute in order to set up a Common Geospatial DataBase.

---

<sup>1</sup> [rbarriga@igm.cl](mailto:rbarriga@igm.cl). Fax: (562) 4606978

<sup>2</sup> [mladvis@igm.cl](mailto:mladvis@igm.cl) Fax: (562) 4606979

<sup>3</sup> Servicio Hidrográfico y Oceanográfico de la Armada de Chile, [www.shoa.cl](http://www.shoa.cl)

<sup>4</sup> Servicio Aerofotogramétrico de la Fuerza Aérea de Chile, [www.saf.cl](http://www.saf.cl)

<sup>5</sup> Centro de Investigación en Recursos Naturales, [www.ciren.cl](http://www.ciren.cl)

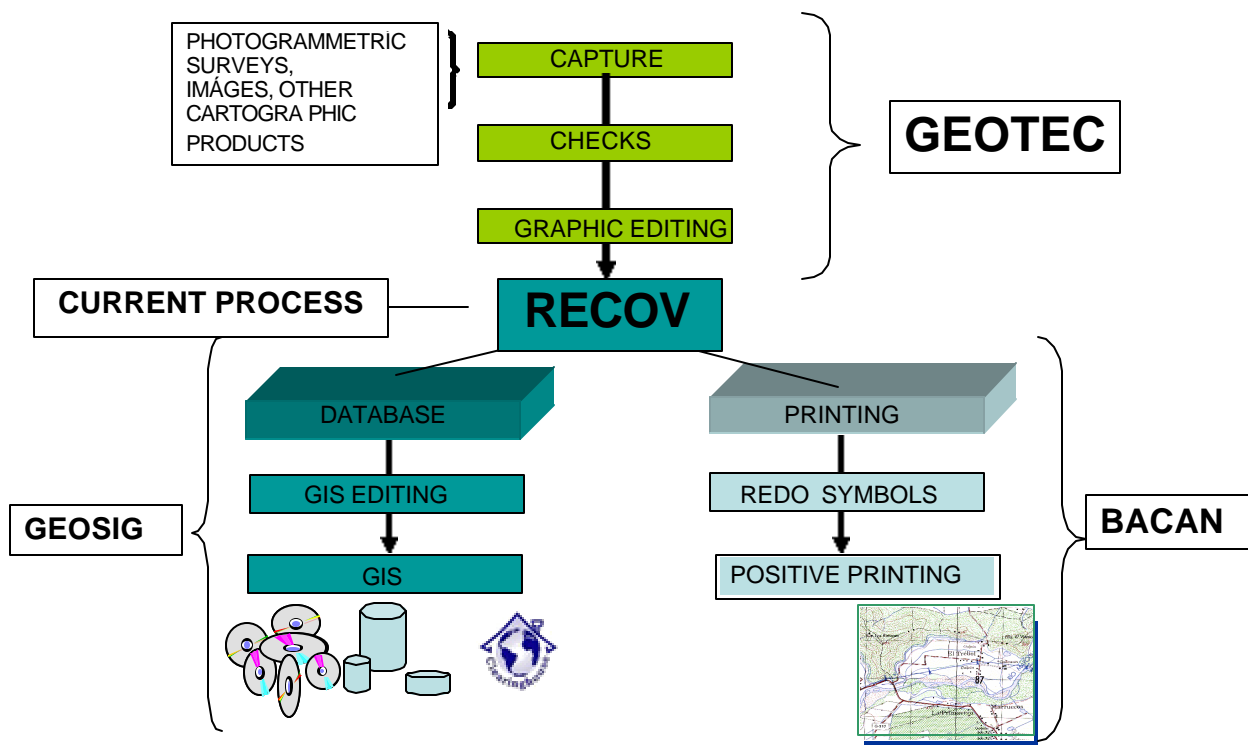


Figure N° 1: IGM Main Projects

**GEOTEC Project :** This involves transforming the regular analogue cartography to digital cartography. This process lasted about 5 years, with only a small area of Tierra del Fuego Island still to be covered in the digital cartography, due to the fact that it has not been possible to obtain images (aerial photographs) given the difficult atmospheric conditions in this region, a sector of about 1% of the total surface area of the country. In this project, the Hydrographic and Oceanographic Service of the Navy (nautical cartography) and the AeroPhotogrammetric Service of the Air Force (aerial photographs) also participated through their respective types of materials and skills.

**RECOV Project :** This involves editing and optimizing the regular digital cartography in order to set up a structure that makes it suitable for being processed automatically for creating geospatial databases or for publication and printing out.

**BACAN Project :** This involves making the National Geodesic Network homogeneous. The elongated shape of Chile and the slow pace of technological development has meant that at least two Geodesic Reference Datums have been applied in Chile. These will soon be replaced in accordance with current scientific-technological development. The “Geocentric Reference System for the Americas” (SIRGAS) has been defined as part of this, and is directly related to the ITRF (International Terrestrial Reference Framework). At the same time, this project involves the process of publications and the printing of cartography.

**GEOSIG project** : This involves the creation of a GeoSpatial DataBase, aiming to integrate digital cartography with the corresponding databases for the attributes of each one of the graphic elements contained in it.

## 2. NATIONAL GEOSPATIAL DATA INFRASTRUCTURE

The State of Chile, within the framework of a series of initiatives, some of which have been running for some time, has started to set up a "National Spatial Data Infrastructure" (NSDI), following in this way a general tendency to optimize the use of resources and encourage the development of people and society, by making efficient use of geographic information.

With this vision in mind and following a set of initiatives for organizing and putting in order the geographic information of Chile, on the 25<sup>th</sup> of September 2001 the President of the Chilean Republic released the "Instructivo N° 14"<sup>6</sup> (a official instruction or order), establishing the creation of the "**National Territorial Information System**" (SNIT), in this way giving the initial impulse and political guidance for the setting up of the NSDI, covering the following three fundamental objectives to be fulfilled during the year 2002 :

- *Create an inventory of the Territorial Information present in Chile.*
- *Standardize the acquisition, creation and transfer of all territorial data.*
- *Devise a national plan for capturing and standardizing territorial information.*

The political coordination of this project is the responsibility of the "Committee of Ministers for the City and the Territory", while the technical coordination is under the guidance of the "Ministry of National Assets and Resources".

### **National Territorial Information System (SNIT.)<sup>7</sup>**

To quickly and efficiently put Instruction N° 14 into effect, and taking into account the urgent need to improve the use of the resources of geographic information available in the country, a 'Work Group' has been set by the "Committee for Technical Coordination and Thematic Work Areas". These have conceived a "Work Plan" making it possible to execute in reasonable time - during the year 2002 - the tasks set by the President of the Republic.

#### **Committee for Technical Coordination :**

Made up of representatives from the 'Committee of Ministers for the City and the Territory', that is, by members of the Ministries for the Interior, for Public Works (Transport and Telecommunications), for Finance, for Housing and Urban Development, for National Assets and Resources, for Planning and Cooperation, for the Economy, and for Education, also the General Secretaryship of the Presidency, with the Ministry of Defence finally joining on account of having attached to it the main producers of Geographic Information, these being the Military Geographic Institute, the Hydrographic and Oceanographic Service of the Navy and the AeroPhotogrammetric Service of the Air Force.

#### **Thematic Work Areas :**

For a better performance of this work, it has been organized into thematic areas, which are the following :

<sup>6</sup> Presidential "Instructivo N° 14", 25th. SEP.2001

<sup>7</sup> Medina Alvaro, Ministry for National Assets and Resources, [amedina@mbienes.cl](mailto:amedina@mbienes.cl)

AREA	COORDINATOR
Infrastructure	Ministry of Public Works, Transport and Telecommunications
Basic Territorial Information	Military Geographic Institute
Social	Ministry for Planning and Cooperation
Natural Resources	Center for Natural Resources Research
Property	S.I.I. (domestic taxation service)
Cultural Heritage	National Libraries and Archives Office – National Commission for Conservation and Restoration.
Regions	Sub-Secretaryship for Regional Development
Territorial Planning	Ministry of Housing and Urban Development

**Table N°1: National Information Territorial System Thematic Work Areas**

In the context of the SNIT, the IGM has had an active participation in this, by means of a group of its professional staff who have kept in mind the recommendations of the GSDI, the CP-IDEA and the IPGH organisations, using in particular “The SDI Cookbook”<sup>8</sup> of the Global Spatial Data Infrastructure - GSDI as a reference guide for spatial data infrastructures.

### **"Work Plan" for the Achievement of the Basic Objectives<sup>9</sup>:**

#### ***Creation of an Inventory of Territorial Information (TI) of the Country :***

By means of this inventory it is intended to set out the thematic areas of TI, identify and characterize the producing and user institutions of this TI, discover the interrelations that exist among them, find where interests regarding TI are similar or comparable (in order to order them by shared priorities), and identify areas where TI is either lacking or duplicated. Work on this inventory was started on the 12<sup>th</sup> of August this year and is due to be finished in September 2002, being performed by an external consulting organisation. This survey was designed according the terms of reference drawn up by all the public institutions coordinated by the Committee for Technical Coordination. The Work Groups of the individual thematic areas are actively participating in the performance of this task.

The above-mentioned survey<sup>10</sup> was put into effect by means of a design implemented on the Internet, thus allowing for a direct access to 527 State bodies able to answer the questionnaire. In this way it was intended to make it easy for the entities surveyed and at the same time be able to statistically process the data.

#### ***Standardization of the acquisition, creation and transfer of all territorial data :***

This major objective involves comprehending the process for producing standards by thematic area, identifying the basic or primary areas to be standardized, defining the costs and time needed for the standardization process in order to draft a medium-term work plan. This plan, organized by area or topic, should be finished by the end of the year 2002. In terms of the methodology, the development of the above-mentioned themes should be

<sup>8</sup> The SDI Cookbook, guide to spatial data infrastructures, Version 1.1 (May 2001), Edited by Douglas D. Nebert, Technical Working Group Chair, GSDI, [www.gsdi.org](http://www.gsdi.org)

<sup>9</sup> Medina Alvaro, Minister for National Assets and Resources, Standards Workshop, Santiago, Chile, 30<sup>th</sup> of April 2002. [amedina@mbienes.cl](mailto:amedina@mbienes.cl)

<sup>10</sup> [www.sonda.cl/cuestionario](http://www.sonda.cl/cuestionario)

achieved by means of work done by area, with the additional help of the 'National Institute for Standards' and the National Science and Technology Committee<sup>11</sup>.

The procedure for the adoption of any standard in Chile is based on that established by the National Institute for Standards<sup>12</sup>, and when used to study standards this involves applying criteria recognised and validated internationally (ISO/OMC). For the drafting of Chilean standards, the procedure is as follows :

- A **request** for a standard to be studied can be presented to the "National Institute for Standards" (INN).
- This request becomes a **Preliminary Standards Project**, based on a Chilean or foreign standard, which is subject to a period of public consultation (30 days) by means of its being published in a newspaper distributed nationally.
- Once the period of public consultation has finished, a **"Standards Project"** is assigned to a **Technical Committee** set up for the purpose. This committee is made up of representatives from all sectors related to the topic to be standardized (producers, users, government, scientific and technical areas), which are coordinated by an impartial Technical Secretary named by the INN. Agreements are reached by consensus, this being achieved when there is no sustained opposition on significant matters from a major part of any sector of the interest groups involved and by a process that takes into account all the points of view of all interested parties, reconciling divergent positions.
- Once these agreements are reached, the project for a standard is presented to the INN governing board for approval. Once approved, the project for the standard is called a **'Chilean Standard'**.
- The final step is for the INN to send the Chilean Standard to the appropriate Ministry, in order to become an **'Official Chilean Standard'**.

***Devise a national plan for capturing and standardizing territorial information.***

After the Work Groups for the thematic areas have defined what to standardize and how to do it, also defining the priorities, both in standardisation and in the definition of equivalences and forms of compatibility in the TI; defining too the criteria for access to the TI that they hold, then all of this information will be placed into a "National Plan for Data Capture and Standardisation", which will enable the country to have a new way to manage TI in order to make it more efficient and effective in supporting the taking of political and administrative decisions regarding territory. This plan is part of the overall State Reform and Modernization project in that which involves the management of territorial information. This task should be finalized by the end of the year 2002 and will be the result of intense work by the thematic area Work Groups, together with the Technical Coordination Committee.

---

<sup>11</sup> Prat Ana María, "Comision Nacional de Investigacion en Ciencia y Tecnologia", Standards Workshop, Santiago, Chile, 30<sup>th</sup> of April, 2002.

<sup>12</sup> Ceruti Leonor, "Instituto de Normalizacion Nacional", Standards Workshop, Santiago, Chile, 30<sup>th</sup> of April, 2002

### 3. CONCRETE ACTIONS OF THE IGM FOR THE ESTABLISHMENT OF THE N.S.D.I. IN CHILE:

#### *Development of Spatial Data - Creation of Data for Multiple Uses:*

The Military Geographic Institute (IGM) has developed a structure for its system of digital cartographic production, for both the regular cartography (which covers all the territory of Chile) and the large scale cartography (urban studies). At the same time, work has also been done around the geodesic reference framework, based on the world geodesic system of the year 1984 (WGS-84), which is closely tied to the Global Positioning System (GPS).

The cartography has been structured on the basis of an adaptation of the specifications of the PanAmerican Institute for Geography and History (IPGH) and in accordance with the recommendations of the NIMA, especially the codes used for each of the elements that are represented graphically in the cartography, and the association of the attributes with the alphanumeric databases.

## REGULAR CARTOGRAPHY

### Military Geographic Institute

#### A) CONVENTIONAL (IPGH, ICA, NIMA)

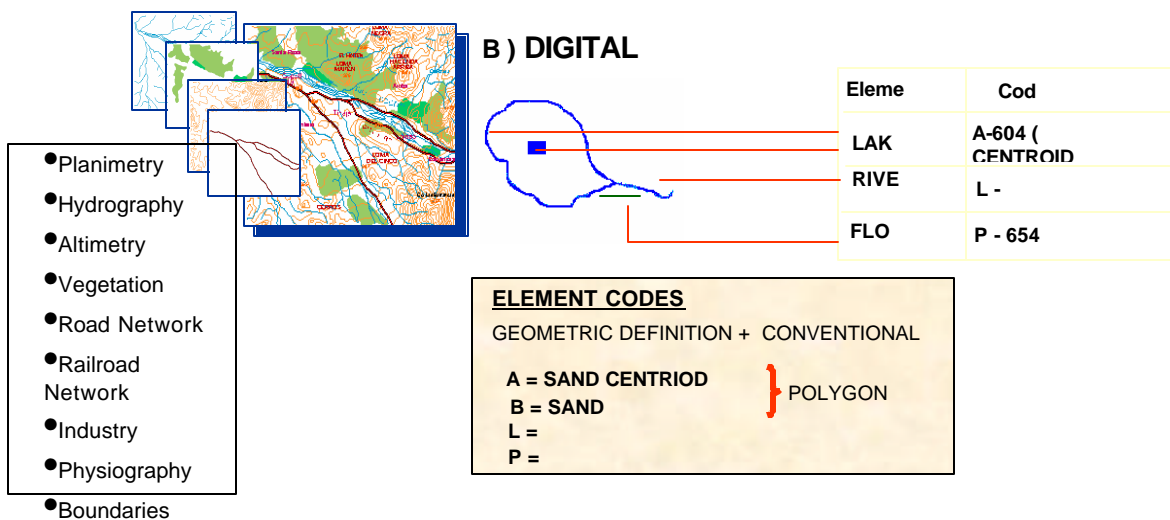
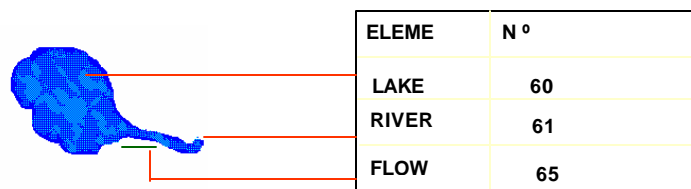


Figure N° 2: Cartographic Structure

#### Integrated Territorial Information System

Using digital cartography at 1:250,000 scale it has been possible to contribute to the project called the “Integrated Territorial Information System”<sup>13</sup> led by the Chilean National Congress Library, this being a system currently functioning within the Chilean Congress,

<sup>13</sup> Utreras, Juan-Carlos, Chilean National Congress Library

constituting a valuable example of integration and of interoperability, because data from a series of organisations converge and combine there, including that from the Military Geographic Institute, the National Institute for Statistics, the Highways and Roads Office, etc. This provides valuable information to the congress members, enabling numerous analyses and applied studies that make it possible to improve the activities of the National Congress in the pursuit of benefits for the political, social and economic development of the nation.

### **Global Mapping Project**

With the cooperation of the Aerophotogrammetric Service of the Air Force of Chile, who have provided a digital map of Chile at 1:1,000,000 scale, it is estimated that the processing and technical structuring of this data will soon be completed in order to contribute to the Vector layers of the Global Map project. Subsequently an update to the Raster layers would complete the Chilean contribution to the full, international version of the Global Map. Nevertheless, the legal aspects have to be kept in mind, so this transfer will be made once this cartography has been approved by the Frontiers and Boundaries Commission of the Foreign Affairs Ministry.

### **Metadata - Description of GeoSpatial Data**

In the same context, the Military Geographic Institute of Chile is currently developing and pushing forwards the implementation of a 'Clearinghouse' with the aim of putting in order and unifying the distribution of the metadata for the available geographic information. For this reason the rules established by the FDGC are being used in accordance with the recommendations of the PanAmerican Institute for Geography and History (IPGH). Currently the metadata for Cartography at 1:500,000, 1:250,000 and 1:50,000 scales has been made available, access to this being possible through the IGM web site at [www.igm.cl](http://www.igm.cl).

### **Catalogue of GeoSpatial Data – Locating Data**

For the development of a Catalogue of GeoSpatial Data (Data Feature Catalogue), various models applied in other countries are being studied, in order to combine compliance with the existing standards, mainly those of ISO TC 211 and of OGC, with the experiences achieved internationally and adapt this to the real situation in Chile.

In this context two data models have already been created in Chile, one developed jointly by the IGM and the Military Polytechnic Academy<sup>14</sup>, and the other by the Ministry for Housing and Urban Development<sup>15</sup>. Although the designs of these models are oriented towards different fields of application, both serve as starting points for making comparisons and developing a national catalogue of geospatial data.

Consequently a prototype is being developed, based on the ISO standard, applying an Object Oriented design using UML.

### **Viewing of GeoSpatial Data – Web Cartography**

By means of an agreement for mutual cooperation between the IGM and the Chilean 'National Congress Library', it is expected to have available within a reasonable period

---

<sup>14</sup> Military Polytechnic Academy of the Army of Chile; [www.acapomil.cl](http://www.acapomil.cl)

<sup>15</sup> Ministry for Housing and Urban Development, System for Territorial Information, [www.sit.cl](http://www.sit.cl)

digital cartography available through the Internet. In the first phase this would be cartography at 1:250,000 scale.

For the time being the IGM has a system of electronic commerce where the cartography is paid for “off line”. In the following phases of this project it is intended to incorporate a system of three levels (GeoSpatial DataBase, applications, and services for users) which would make possible the sale and/or transfer of cartography directly through the Internet.

### **Access to and Distribution of GeoSpatial Data – Open Access to Data**

Even when, in the most diverse spheres of activity, the need to allow free access to geographic data is recognised, it is not always possible to put this into effect, mainly due to the legal restrictions involved. Moreover, the obligation that the organisations producing geospatial information such as the IGM have to finance themselves is fully present and felt by them, which implies that when the data is available they are bought, normally without any restrictions. The sale prices, generally and on the whole, are close to the cost of reproducing them and keeping them up to date.

### **Public Outreach and Training : Creation of a Community**

The IGM participates in certain aspects of international cooperation in Latin America through the ‘Permanent Committee for GeoSpatial Data of the Americas (CP-IDEA), sustaining an adequate level of coordination and correspondence with all the work groups that make up the CP-IDEA. This complements participation in the Cartography Commission of the IPGH, whose new structure, approved in the General Assembly of the year 2001, is set out in such a way as to encourage the implementation and consolidation of the Spatial Data Infrastructure concept at national and continental levels.

In parallel with this, also in the international sphere, there is a very good level of cooperation with the Scientific Committee for Antarctic Research (SCAR), specifically with the Committee of Experts in Geodesy and Geographic Information, which has made it possible for us to gain knowledge of interesting experiences oriented towards the development of infrastructures of this type, these having a special importance for the Antarctic Continent, considering the fact that the continent brings together groups of the most diverse national and scientific origins. This makes it necessary for all concerned to have the basic means of cooperation and interoperability needed for the development of the various projects and their complementary activities.

In the national context, for several years a series of seminars and workshops has continued to be held, in order to spread awareness and encourage the development of a National Geospatial Data Infrastructure. At these meetings people have participated representing various organisations (governmental, public, academic and private), experiences have been shared, and steps have been taken to build the mechanisms of cooperation and related activities which enable the expected interoperability of geospatial data, all oriented towards the development of the country.

### **Conclusions**

The performance of the project for the ‘national territorial information system’ constitutes the concrete expression of a decision of the state of Chile to obtain an infrastructure for geospatial data, which provides a powerful means of supporting the social and economic development of the country. At the same time, this governmental initiative has served as a reference framework that enables an interesting and unifying teamwork, in which, going

beyond simply encouraging individual organizations to lead the way, it is intended to benefit the welfare of the nation as a whole. The possibilities for achieving the desired development depend on having available this type of infrastructure on which can be based public and private planning processes which guide the various programs involving both investment and social management.

The future will be promising once the proposed objectives are fulfilled, for this reason it is essential to sustain and increase the level of international cooperation, above all to obtain the experiences of those countries which have already achieved most of this task. At the same time Chile is willing to provide its own experience, nevertheless, to be modest we recognize that we have only just started along this route, so we invite all the various entities involved to work towards not only a regional development but also the betterment of all mankind. Many of our fellow beings in various parts of the world, are not able to wait, they can only rely on our efforts, which will probably not provide a complete solution, but will make it possible to have available the necessary tools with which the desired solutions can then be built.

### **Acknowledgements**

Special thanks are due to the members of the 'committee for technical coordination' of the national territorial information system project, to the coordinator of the 'integrated territorial information system' project at the national congress library, and to the members of the basic territorial information area and all of the organizations that are contributing in direct or indirect procedures to the creation of the Chilean NSDI.