Spanish Society of Cartography, Photogrammetry and Remote Sensing (SECFYT)

NATIONAL REPORT
SPAIN
2003-2007

National Report Submitted to the 14th General Assembly
of the International Cartographic Association

4-10 August 2007
Moscow, Russia

Summary

1. General 5

2. National Mapping Organizations 9

2.1. National Geographic Institute 11
2.2. National Center of Geographic Information 19
2.3. Publications Office. Ministry of Development 21
2.4. Spanish Army Geographic Center 23
2.5. Spanish Institute of Oceanography 27
2.6. Technological and Geomining Institute of Spain 29
2.7. Cadaster Management Center and Tributary Cooperation 31

3. Regional Mapping Organization 35

3.1. Cartographic Institute of Catalonia 37
3.2. Cartographic Institute of Andalusia 47
3.3. Territorial Information System of Galicia. A Coruña Province Council 59

4. Cartographic Educational Centers 61

4.1. Superior Technical Schools of Engineering in Topographic, Geodesy and Cartography 63

5. Other Cartographical Centers 77

1. General

Cartographic activities in Spain between 2003 and 2007 have been characterized by the increased production of large-scale maps, topographical and thematic maps, and orthoimages at different scales. As you can see in detail in the National Report it has been achieved one main goal in coordination of Spanish cartographical activities. A new administrative regulation has been developed by the National Geographic Institute (IGN) (Ministry of Development) and includes, on voluntary basis, all Autonomous Governments. A positive example of that is the National Plan for Aerial Orthophotography (PNOA), continuous coverage of Spain with 50 cm resolution colour orthophotography, made jointly in a cooperative way by National and Regional governments under IGN coordination, also we can mention Land Cover & Land Use Information System (SIOSE) and the GIS for Land Cover & Land Use in Spain with 1:25,000 resolution.

Within the field that concern the IGN we would like to highlight the Numeric Cartographic Database (IGN) at 1:25,000 (BCN25). Database, homogeneous and continuous in the national territory and with topological structure, the Digital Terrain Model of 10 x 10 m. grid, 3 m accuracy, with national coverage and continuously updated.

A new project was elaborated by the National Geographic Institute, it is CartoCiudad the Spanish official cartographic Database done through data harmonization of national and regional cartographic databases, urban cadastral database, addresses database and post codes databases from national, regional and some local governments, to be used in location-based services, cartographical visualization of urban and non-urban zones with no gaps, spatial analysis and navigation on the Spanish road-street network. CartoCiudad database is managed by the CartoCiudad SDI geographical services, Open Gis Consortium (OGC) web services.

As all of you know the first edition of the National Atlas of Spain (IGN) was finished in 1997. Now is presented in two versions, in CD-ROM/DVD (47 units) and in volumes (6), and has more than 2,000 pages with more than 4,000 maps.

The National Center for Geographic Information (CNIG) has the commitment of covering the demand of the cartography and geographic information of the Spanish society.

This includes the elaboration of derived and thematic products and international and national distribution, with special dedication to the creation of projects based on advanced technology, research and development programs and the lending of technical assistance in the fields of sciences and geographic techniques.

The CNIG has successfully completed the possibility of sending the cartographic series 1:25,000 (detail scale) to mobile phones, and has successfully developed an autonomous system able to impress and to furnish a sheet of National Topographic Map 1: 25,000

The Spanish Army Geographic Centre is involved in the geographic policy of the NATO and takes part in the steering meetings of Digital Geographic Information Working Group (DGIWG-TC and DGIWG-SC), in the meetings of Interservice Geographic Working Group (IGEOWG) of NATO, in the NATO Geographic Conference. The Spanish Geographic unit, it is able to deploy to the operations theatre, all these elements that are necessary to provide the accurate geographic information to the national and international forces on the ground in the right time, including IPB (Intelligence preparation of the battlefield), the flow of maps making, presentation, distribution of this information .

This Unit has taken part in a lot of exercises, and operations all across its four years of living, and in the same way national and international conferences and meetings. It has produced ortophotomaps of humanitarian aid areas in Bosnia Herzegovina, Kosovo, Congo, Afghanistan, Iraq, Lebanon and Pakistan.

The Spanish Cadastre is an administrative registry of universal and exhaustive nature. At present, about 74 million real estates are registered. The cadastre has physical, legal and economic data of each of them, like the surface, use, owner or value, as well as those data necessary for the unequivocal identification of the cadastral parcel, the unique alphanumeric code that is assigned to each of them, as well as its obligatory cartographic representation.

The cadastral cartography is available in standard Web Map Service (WMS) since September 2005 for its consultation through different Spatial Data Infrastructures. Since then 35 million maps have been consulted. Nowadays a pilot project to offer the cadastral cartography in standard Web Feature Service (WFS) and, consequently, to facilitate its unloading in vectorial format is being tested.

In the field of regional cartography, we must point out the excellent achievements of the Catalonian Cartographic Institute (ICC), since it was founded the ICC has brought a high degree of innovation and modernity to the cartographic studies and production undertaken in Catalonia; furthermore, it ensures that high-quality cartography is available to offer planning and support to a wide range of territorial initiatives. Its purpose, then, is to carry out the technical tasks involved in the development of cartographic and geological information.

ICC has introduced a new policy to circulate their digital database products free of charge. In the period 2003-2006, the total number of downloads of digital cartography via Internet was 854,800, and the web received 2.914.692 visits.

The Cartographic Institute of Andalusia, also with excellent achievements, facilitates support to the Autonomous Administration in the ordination of the territory, town planning, infrastructures, as well as in other sectors such as: agriculture, environment, culture, emergencies, etc. in their territory. Andalusia update their basic cartography to territorial scales periodically (1:10,000, 1:5,000) and urban (1:2,000, 1:1,000, 1:500), as well as their corresponding Photogrametry flights.

Through an agreement with the University of Jaen a project of statistical evaluation of parameters of quality was carried out, in order to obtain precise and quantified metadata. This project has allowed docu-

menting the levels of quality in the infrastructure of spatial data, advance in the elaboration of technical norms and in the establishment of new strategies of production.

We must also mention the high standard of the work carried out by other cartographic departments belonging to regional governments, such as A Coruña Province Council, the Xunta of Galicia, the Regional Cartographic Service of Madrid, Canary Islands Cartography and the Public Works Office of Navarra or the Cartographic Institute of Valencia, which are dealing with the basic digital cartography of rural and urban areas at large scales, and also general and thematic maps at medium scales.

In the field of thematic cartography, we must mention the work carried out by the Technological and Geomining Institute of Spain, the National Meteorological Institute, the Spanish Oceanographical Institute and the Ministry of Agriculture on the different aspects of activity.

Cartography, Geodesy, Photogrammetry and Remote Sensing are taught at most Spanish universities. The largest number of specialist are educated at the Superior Technical Schools for Engineering in Topographic, Geodesy and Cartography —there are 6 centers in Spain (Alcalá de Henares, Extremadura, Jaén, Madrid, Valencia y Salamanca)— and of Technical Topographic Engineering —currently, there are 9 centers in Spain— (Extremadura, Jaén, Las Palmas de Gran Canaria, Oviedo, Salamanca, País Vasco, Cataluña, Madrid y Valencia).

To finish this report and on behalf of the Spanish Society for Cartography, Photogrammetry and Remote Sensing, that has been honoured by ICA with the commitment of the organization of 2005 International Cartographic Conference held in the city of A Coruña, we want to express now our appreciation for it to ICA and to all attendants, more than 1.600 active participants.

It is very pleasing to remain that the Spanish cartography has been rewarded with several in the last International Map Exhibition:

ICC Durban 2003
International Map Exhibition
XXI International Cartographic Conference

— Award for excellent in cartography, selected by Official Jury in the category "Topographic Map"
  - Map of Autonomous Comunicad Valenciana
    1: 300,000, *National Geographic Institute of Spain*
  - Guide Map of Sierra Nevada- Las Alpujarras.
    1:100,000, *National Geographic Institute of Spain*

— Award for excellent in cartography, selected by Official Jury in the category "Relief Map"
  - Relief Map of Península Ibérica, Baleares y Canarias
    1:1,250,000, *National Geographic Institute of Spain*

— Award for excellent in cartography, selected by Official Jury in the category "Urban Map"
  - Urban Map of Pamplona.
    1: 500, Government of Navarra

– Award for excellent in cartography, selected by the Delegates in the category "Topographic Map"
  - Guide Map of Sierra Nevada-Las Alpujarras.
    1:100,000, *National Geographic Institute of Spain*

– Award for excellent in cartography, selected by the Delegates in the category "Relief Map"
  - Relief Map of Península Ibérica, Baleares y Canarias
    1:1,250,000, *National Geographic Institute of Spain*

– Award for excellent in cartography, selected by the Delegates in the category "Other"
  - Sísmic Hazard Europa-Mediterráneo
    1:5,000,000, *National Geographic Institute of Spain*

ICC A Coruña 2005
International Map Exhibition
XXII International Cartographic Conference

– Award for excellent in cartography, selected by Official Jury in the category "Relief Map"
  - *Relief Map of Sierra Nevada-Las Alpujarras 1:100,000 National Geographic Institute of Spain*

– Award for excellent in cartography, selected by the Delegates in the category "Relief Map"
  - *Relief Map of Galicia 1:250,000 National Geographic Institute of Spain*

– Award for excellent in cartography, selected by the Delegates in the category "Other"
  - *Submarine Relief Map of of Catalunya 1:250,000 Cartographic Institute of Catalonia*

2. National Mapping Organizations

2.1. National Geographic Institute
2.2. National Center of Geographic Information
2.3. Publications Office. Ministry of Development
2.4. Spanish Army Geographic Center
2.5. Spanish Institute of Oceanography
2.6. Technological and Geomining Institute of Spain
2.7. Cadaster Management Center and Tributary Cooperation

2.1. National Geographic Institute

General Ibáñez de Ibero, 3
28003 Madrid - Spain
Phone: +34 91 5977000
Fax: +34 91 5979765

Since its foundation in 1870, the National Geographic Institute of Spain (IGN) has been engaged in scientific investigations and production activities in the field of mapping. IGN is also engaged in activities related to astronomy, geodesy, geophysics, photogrametry, remote sensing and administrative boundary lines.

Summary of IGN cartographic products and numeric cartographic database:

- National Basic Cartography: National Topographic Map at 1:25,000 and 1:50,000.
- National Topographic Map at 1:25,000 (MTN25). New version in paper and digital format (vector and raster) in continuous updating.
- Numeric Cartographic Database at 1:25,000 (BCN25). Database from planimetry of national topographic map at 1:25,000, homogeneous and continuous in the national territory and with topological structure.
- Digital Terrain Model of 25 x 25 m. grid , 4 m accuracy, with national coverage and fully finished.
- Digital Terrain Model of 10 x 10 m. grid , 3 m accuracy, offers national coverage; it is fully finished and continuously updated.
- National Topographic Map at 1:50,000 (MTN50) started the updating of the series through generalization of 1:25,000 scale.
- Geographical Information System on Boundary Lines. It includes the Documentary Information System of Boundary Lines of Spain (SID-DAE).
- CartoCiudad the Spanish official cartographic Database done throught data harmonization of national and regional cartographic databases, urban cadastral database, addresses database and post codes databases from national, regional and some local governments, to be used in location-based services, cartographical visualization of urban and non-urban zones with no gaps, spatial analysis and navigation on the Spanish road-street network. CartoCiudad database is managed by the CartoCiudad SDI geographical services (OGC web services).
- Derived and Thematic Maps.
- Provincial Maps at 1:200,000.
- Series of Provincial Maps at 1:200,000 (MTN200). Since 1999 the serie is updated and digitalized from the Numeric Cartographic Database at 1:200,000 (BCN200).
- Numeric Cartographic Database (BCN200). National coverage and yearly updated.
- Digital Terrain Model (MDT200) of 200 x 200 m. grid. National coverage continuously updated.

  - Map of Spain at 1:500,000 scale in paper and digital format (vector and raster).

  - Map of the Iberian Peninsula, Balears and Canary Islands at 1:1,000,000 scale in paper and digital format (vector and raster).

- Maps of the Spanish Autonomous Regions.
- Production of a new version of the several "multi-provincial" autonomous maps in digital and in a new style format.
- National Plan for Aerial Orthophotography (PNOA)

  - Continuous coverage of Spain with 50 cm resolution color orthophotography, made jointly in a cooperative way by National and Regional governments under IGN of Spain coordination.
  - Orthoimages and other products.
  - Space orthoimages at different scales (1:25,000, 1:50,000, 1:100,000, 1:250,000 and 1:500,000).

- Thematic maps.
- Historical maps.
- Aerial photography at different scales and images from space satellites.
- Other cartographic products and educational materials.
- Land Cover & Land Use Information System (SIOSE).
- GIS for Land Cover & Land Use in Spain with 1:25.000 resolution. It is built from Spot 5 images and PNOA orthophotography.
- Land use Map at 1:100,000
- National Spatial Data Infrastructure (NSDI) of Spain (IDEE).

  - The Spanish Spatial Data Infrastructure (IDEE), opened (www.idee.es) on January 2004, is an example of a collective project based on the cooperation of a large number of actors in Spain: governmental bodies at national, regional and local levels, private companies, universities, citizens, etc., designed to freely offer a wide range of geographic resources on the Internet. Its spirit is based on cooperation and openness through their consensus and experiences according to INSPIRE guidelines, Open Geospatial Consortium (OGC) interoperability specifications and ISO 19100 standards.
  - This project has been coordinated by the National Geographic Council, a governmental body, whose Technical Secretariat is the National Geographic Institute.
  - The IDEE is a distributed, multilingual, internet accessible system in which existing SDIs in Spain cooperates sinergically. It offers a wide range of services compliant OGC standards: Catalogue Service Web (CSW), Web Map Service (WMS), Gazetteer Service (Gaz), Web Feature Service (WFS), Web Coverage Service (WCS), Web Map Context (WMC) and Web Coordinates Transformation Service (WCTS).

CARTOGRAPHIC PRODUCTION PLAN

On cartographic production the activity of the National Geographic Institute has been focused on the development and modernization of the physical resources and geomatic tools which, as a mapping producer, is using these resources as tools to make numerous cartographic products in the era of geoinformation in which we are immersed. This lead to the development and innovation of the following techniques in the different production phases:

- Data capture techniques, with digital photogrametry , being the most important as the head of them, together with fast and effective GPS- surveyings (by the displaying of artificial satellites) constitute the best Data Capture Techniques.
- Information processing techniques by means of graphic design and digital edition tools, that in edition are in continuous evolution.
- Automated design and cartographic production techniques such as the design and digital imposition of texts and graphics, the laser plotter of film for offset printing, and the folding and finish process.
- Check of process an implementation of quality system in the different units and production phases that form part of the carrying out of cartographic projects, and in general of the geographic information projects.

  - Generalized use of GIS tools and techniques.
  - Use of SDI technologies.

On the other hand, the National Geographic Institute, with new and innovative products and the commitment of adapting the services to evolution of market demand, has given place to the incorporation of new lines of cartographic projects, for example multimedia products, 3D viewer or the called image cartography obtained from scenes taken by transported sensors on spacecraft or airborne.

Formation and publication

Currently, automated cartographic production techniques are fully developed. The experience acquired since 1988, when the National Atlas of Spain was started throught the exploitation of an integrated cartographic production system, has enabled the development of a new methodology. Due to its sufficient contrast, it could be defined as an ambitiosus production project,which has allowed to finish fully MTN25 digital and to begin the new updating of MTN50.

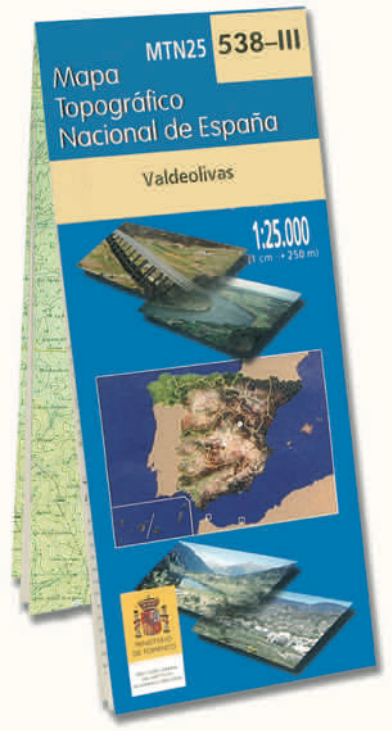
The result during the last years has been excellent for the succesful production level and for the exploitation of new cartographic products (ending of digital MTN25, new MTN50, series of autonomus maps, relief cartography and updating of numeric cartographic database, digital terrain model which has appeared as a result of the introduction of new automated digital process in the different phases of cartographic production.

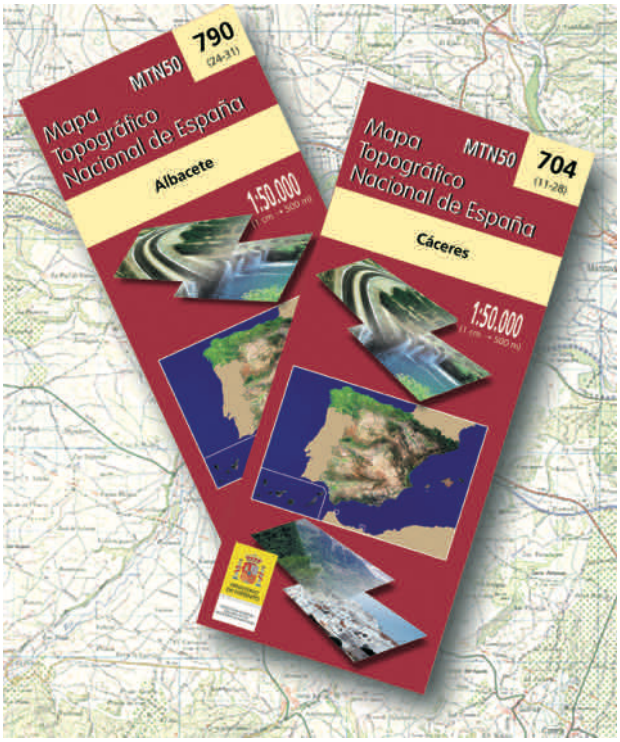
NATIONAL BASIC CARTOGRAPHY

Cartography at 1:25,000 scale (MTN25)

When in 1968 the publication of the 1:50,000 National Topographical Map (MTN50) was finally concluded, work started on the project to prepare a new series of maps.In accordance with a National Cartographic Plan, preparation began for the publication of the sheets at the scale of 1:25,000, under the denomination MTN25.

Nowadays the MTN25 serie is in updating process, following the quinquennial plan of the National Photogrametric Flight, and doing complementary surveyings that are more accurate with GPS techniques.





Cartography at 1:50,000 scale (MTN50)

At the same time,geoinformation technologies allow the obtention of a new digital MTN50, through computer-aided cartographic generalization techniques, with an unthinkable achievement in these years when the serie was finishing its adventure.

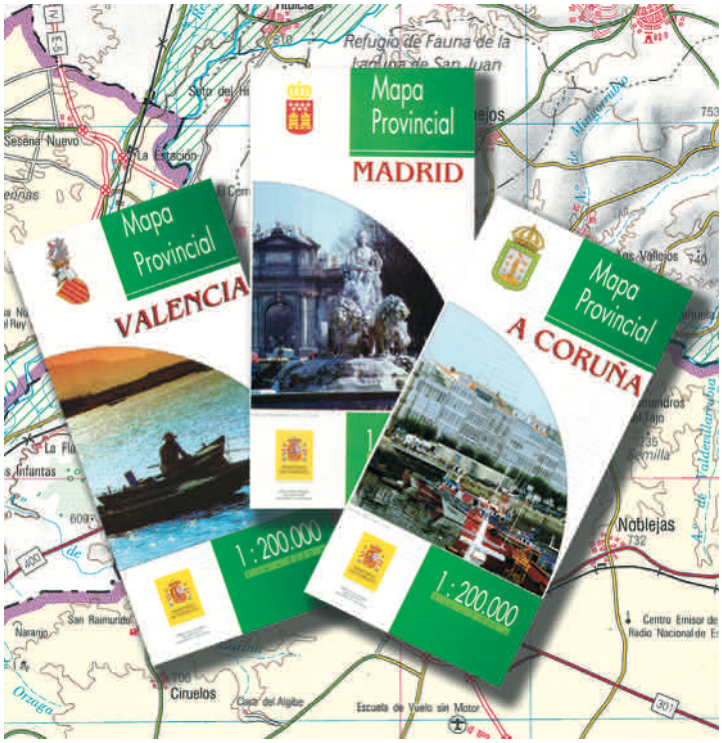
DERIVED AND THEMATIC MAPS

The National Geographic Institute produces and updates the following derived cartography based on edition processes or topograghical generalization contained in existing basic cartography.Likewise, it produces thematic cartography,using as base basic or derived cartography, developping some specific aspect of the geographic information of these, and incorporating specific additional information.

Map series of the Spanish Provinces at 1:200,000 scale

All the Spanish provinces are published (peninsula and islands), as well as the territories of Ceuta and Melilla, on 48 independent maps (the three Basque provinces are featured on one single map) and in spite of their different surface areas, follow fixed formats wich allow all them to have a folded size of 12,5 x 25 cm. These map series are being updated.

Currently, a new digital serie of provincial map is being worked on, with a scale of 1.200,000, completed with data from the national topographical map with a scale of 1:25,000 (MTN25)

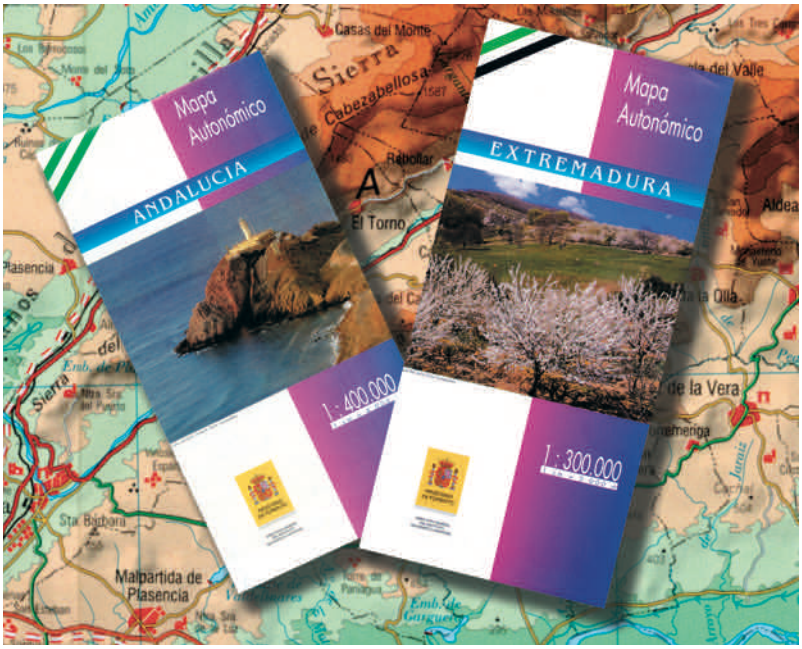


Base 1:200,000 also obtained from BCN200 through generalization and up dated with information from different sources. New updatings of digital base 1:200,000.

Autonomous Map Series

A serie of map of the ten Multi-provincial Autonomous regions are being carried out (the seven once-provincial maps match the provincial serie at 1:200,000 scale. All of them, are made in digital format through provincial maps, changing their scales between 1:200,000 and 1:400,000 according to surface area of each autonomous region.

Map of Spain at 1:500,000 scale, obtained through scanning and vectorization of positive of the sheets of Atlas. A new version of the Map of Spain at 1:500,000 scale in digital format has been finished.



1:1,000,000 base obtained from BCN200 through generalization and updated from different sources; like the official road map and the nomenclador of National Institute of Statistics (INE).

The base has been updated in year 2000 with the edition of the "New General Map of Spain" at 1:1,000,000 sacle according with the not of law proposal approved by the Commission on Infrastructure and Environment of Council of Ministers, on 27th December 1994, which established that the Canary Islands were placed on the southwest of the map.

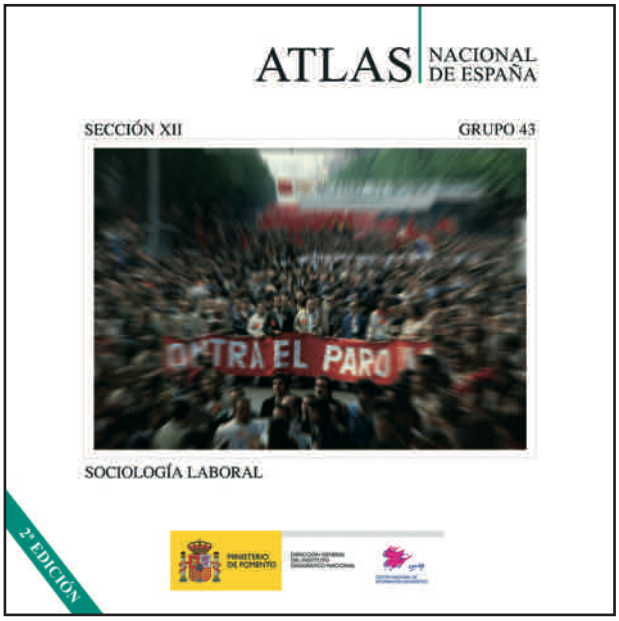
Relief Maps

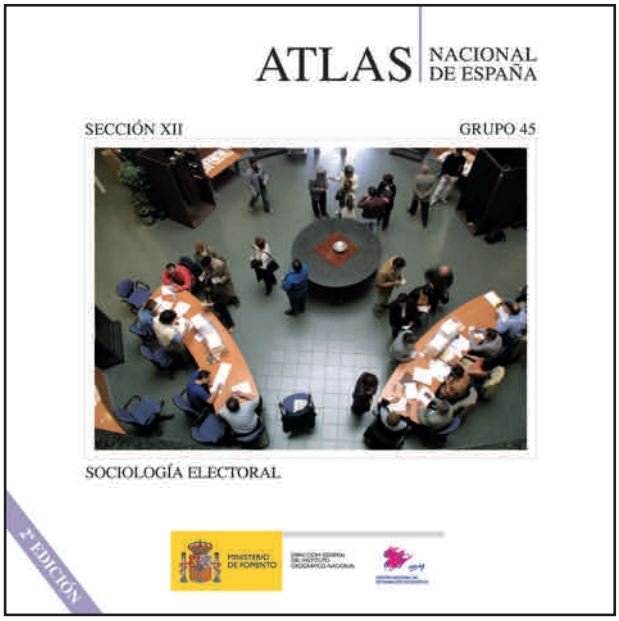
Digital Terrain Model (MDT) and the map, produce some relief maps. For example, it should be mentioned that a new edition of the Physical Map of Iberian Peninsula, Balearics and Canary Islands has been recently produced at 1:1,250,000 scale.

THE NATIONAL ATLAS OF SPAIN

Once the National Atlas of Spain was consolidated, its first edition was finished in 1997.The National Atlas of Spain is presented in two versions, in CD-ROM/DVD (47) and in volumes (6), and has more than 2,000 pages with more than 4,000 maps.

The National Atlas of Spain is devised as a publication in continous evolution, its aim is to contibute to understand the changing and complex reality that the Atlas intend to represent, working on the major advances in information technology, an automated system has been designed that makes its production easier and quicker , so that the information is more up-to-date.





According to new information technologies the production of the Atlas has changed its range of products:

- Atlas published in paper, in big formats as well as in reduced formats.
- Atlas on digital format (CD-ROM and DVD)
- Atlas on Internet.

Revised and abridged version of National Atlas: The Physical Environment.

In book format, it consists of two volumes with a total of 600 pages.The first book includes a map of Spain at 1:500,000 scale along with an toponymical index with some 28,000 entries, as well as tables of geographic data.

The second volume covers information about landscape, geophisics, relief, climatology, hydrology, pedology, biogeography, flora and fauna,protected natural areas and the marine environment.

CD ROM version of National Atlas.

It consists of a cartographic reference module and a thematic reference module.In the cartographic reference module maps at 1:2,000,000; 1:1,000,000 and 1:500,000 scales can be viewed.

The information of each map has been structured in raster layers that allow their individual manipulation.The user has also the posibility of exporting information in order to edit images.

The digital terrain model module includes the possibility to generate profiles,maps of visible and invisible areas,slope maps,hypsometric couloring, and a 3D view of the maps at a scale of 1:1,000,000.

2.2. National Center of Geographic Information

General Ibáñez de Ibero, 3
28003 Madrid - Spain
Phone: +34 91 5979514
Fax: +34 91 5351713

The National Center of Geographic Information (CNIG), created by article 122 of Law 37/1988 on December 28, of General State Budgets for 1989, with the aim of producing, developing and distributing works and publications of geographic character requested by society. This includes the marketing of works by the General Management of the National Geographic Institute, the elaboration of derived and thematic products and international and national distribution, with special dedication to the creation of projects based on advanced technology, research and development programs and the lending of technical assistance in the fields of sciences and geographic techniques.

A Royal Decree of May 25, 2007, approves the new Statute of CNIG, and provides new aims and tasks, including the territorial system for geographical information to the citizens and the "Casa del Mapa" (Map's Shops), network of specialized shops, in all the national territory.

Up to now, the CNIG has established this "Casas del Mapa" in Madrid, Zaragoza, Oviedo, Palma de Mallorca, Santa Cruz de Tenerife, Santander, Palencia, Valladolid, A Coruña y Murcia. Also is in touch with the citizens through the Services of the National Geographic Institute and the "Librerias Indice" network, established together with the National Statiscal Institute.

The supplying of these data, products and publications, as well as the lending of services by the National Center of Geographic Information is done in exchange for economic compensation that has the character of public prices in accordance with those established by article 24 of Law 8/1989, of April 3, of Taxes and Public Prices.

The National Center of Geographic Information provides cartography and geographical information, analogical, and digital and also has published different series of maps and books. From among them, the series of National Parks (map and book-guide) of Caldera de Taburiente (La Palma), Garajonay (Gomera), Teide (Tenerife), Timanfaya (Lanzarote), Ordesa y Monte Perdido (Huesca). Picos de Europa (Asturias Cantabria-León) and Aigües Tortes (Lleida)

The CNIG also Works in projects of new technologies. It has successfully completed the possibility of sending the cartographic series 1:25,000 (detail scale) to mobile phones, and has successfully developed an autonomous system able to impress and to furnish a sheet of national Topographic Map 1: 25,000

2.3. Publications Office. Ministry of Development

Paseo de la Castellana, 67
28071 Madrid - Spain
Phone: +34 91 5978267
Fax: +34 91 5978470

The Official Road Map of Spain is published annually with updated data and distributed as printed map and interactive CD-ROM. More than 160,000 copies are sold every year.

A new project has been created for implementing the Official Road Map in the official web site of the Ministry of Development. The Web version has the added value features of the interactive version in CD-ROM, with route selection and interconnection with 19 databases as population, building works, tourist routes and natural geographic spaces.

It is based on Geomedia Profesional 6.0, Geomedia WebMap Profesional, Map Publisher and Geomedia Objects and supported by Microsoft. NET 2005.

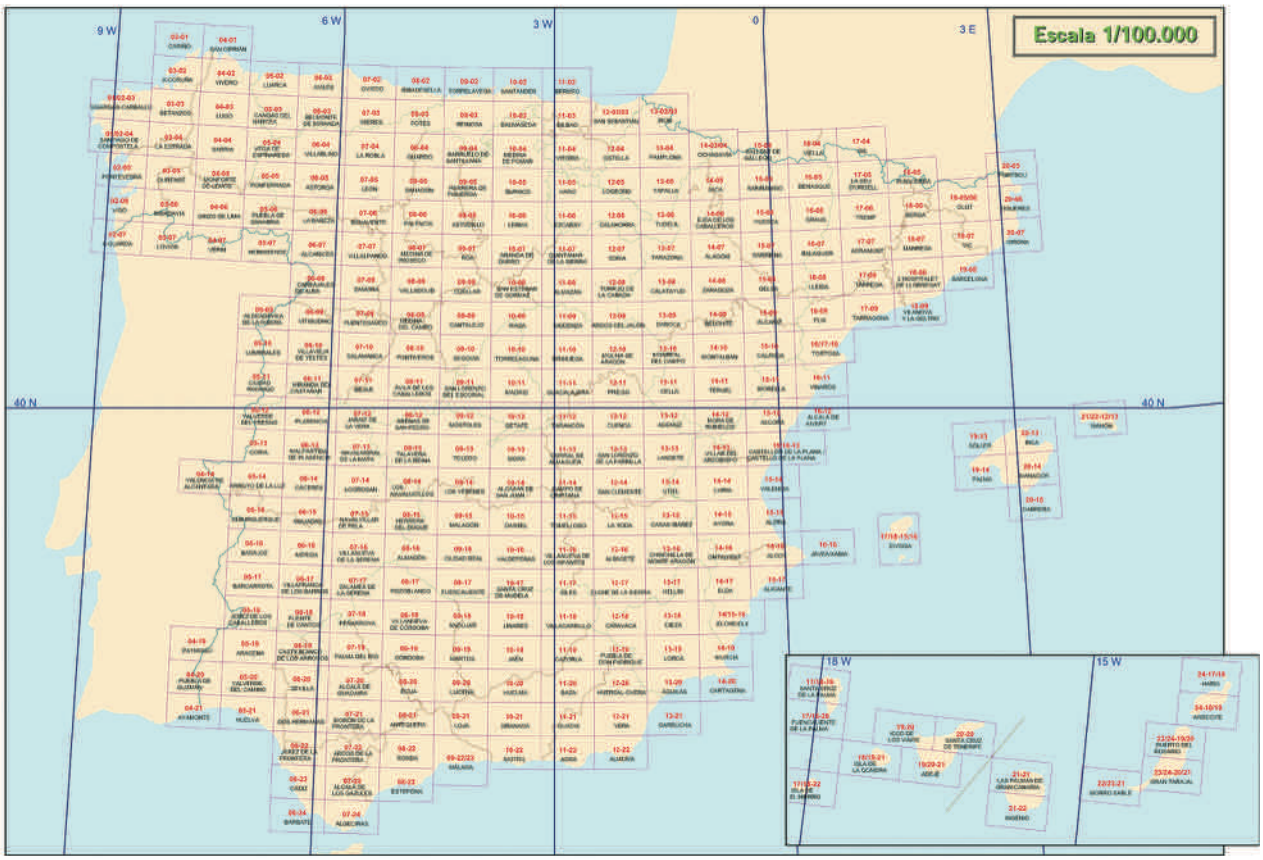
The final products are three identical versions of the same product: printed Map, Interactive version on CD-Rom and Web application. It will be updated daily from Web site.

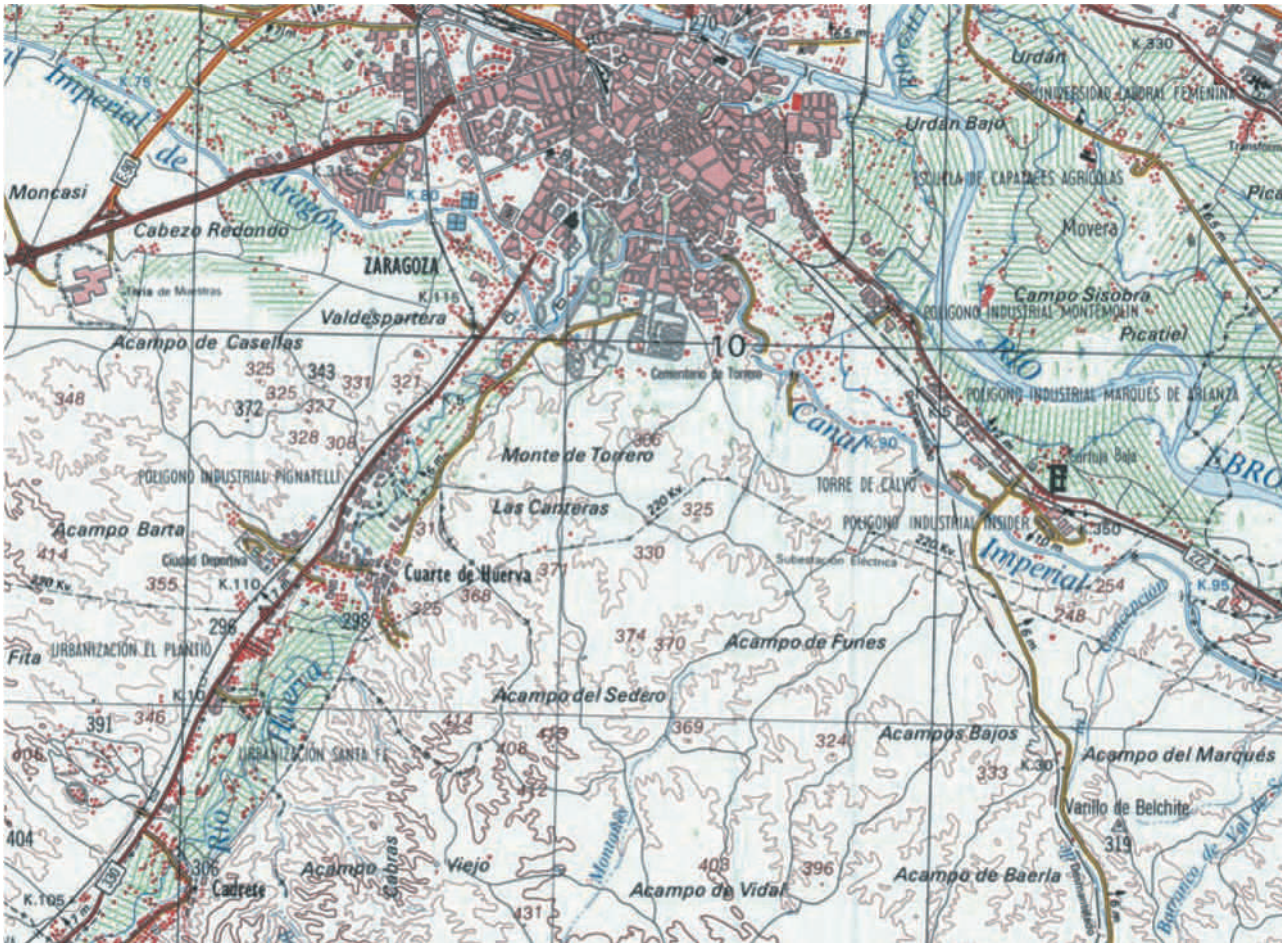
2.4. Spanish Army Geographic Center

Darío Gazapo, 8 - Cuartel Alfonso X
28024 Madrid - Spain
Phone: +34 91 7115043
Fax: +34 91 7117032

Spanish Army Geographic Center goes on with the computer-assisted production of the country's Series L (at 1:50,000 scale), based on aerial photograph at 1:40,000 scale, with field revision, topological validation and database downloading, in order to hardcopy production, digital terrain elevation data creation and vector geographic information compilation. Nowadays we have covered almost the whole surface of Spain. Keeping all these information in an Oracle Geo database environment.

It has been finished the flow design of the C Serie (1:100,000 scale), based upon generalization of the L Series, and its production has begun.





The upgrade and publication processes of the military serie Terrain JOG 1501 (1:250,000) and the same steps has been followed by the 250M serie.

Also, it has been produced many others cartographic products of interest for Spanish Armed Forces at many diverse scales, not only national coverage (for example, Production orders for fulfilling the military units requirements) but also international maps (for example, ortophotomaps of humanitarian aid areas: Bosnia Herzegovina, Kosovo , Congo, Afghanistan, Iraq, Lebanon, Pakistan).

Attend technical meetings of Multinational Geospatial Co-production Program(MGCP), vector map with the 1:50,000 scale information, an all the works involved have been finished in order to certify the quality control processes , not only about the orthorectification process, but also acquisition of information of vectorial information .

The Digital chart, paramount element in the geographic information dealing , has been upgraded, in support of the operative Units, the last version of this software (4.0) has been edited and distributed. This new version include among others new features, the integration of the APP6 simbology, vectorial edition and analisys tools and the supported images formats have been increased.

Spanish Army Geographic Centre takes part in the Spanish National Geographic High Board Council and its commitee meetings, in the technical and steering meetings of Digital Geographic Information Working Group (DGIWG-TC and DGIWG-SC), in the meetings of Interservice Geographic Working Group (IGEOWG) of NATO, in the NATO Geographic Conference and its Southern Regional meetings, in the Latin American geographic institutes directors meetings, in the committee for the maintenance of the border meetings, etc.

The Spanish Geographic unit, it is able to deploy to the operations theatre, all these elements that are necessary to provide the accurate geographic information to the national and international forces on the ground in the right time, including IPB (Intelligence preparation of the battlefield), the flow of maps making, presentation, distribution of this information . This Unit has taken part in a lot of exercises, and operations all across its four years of living, and in the same way national and international conferences and meetings.

2.5. Spanish Institute of Oceanography

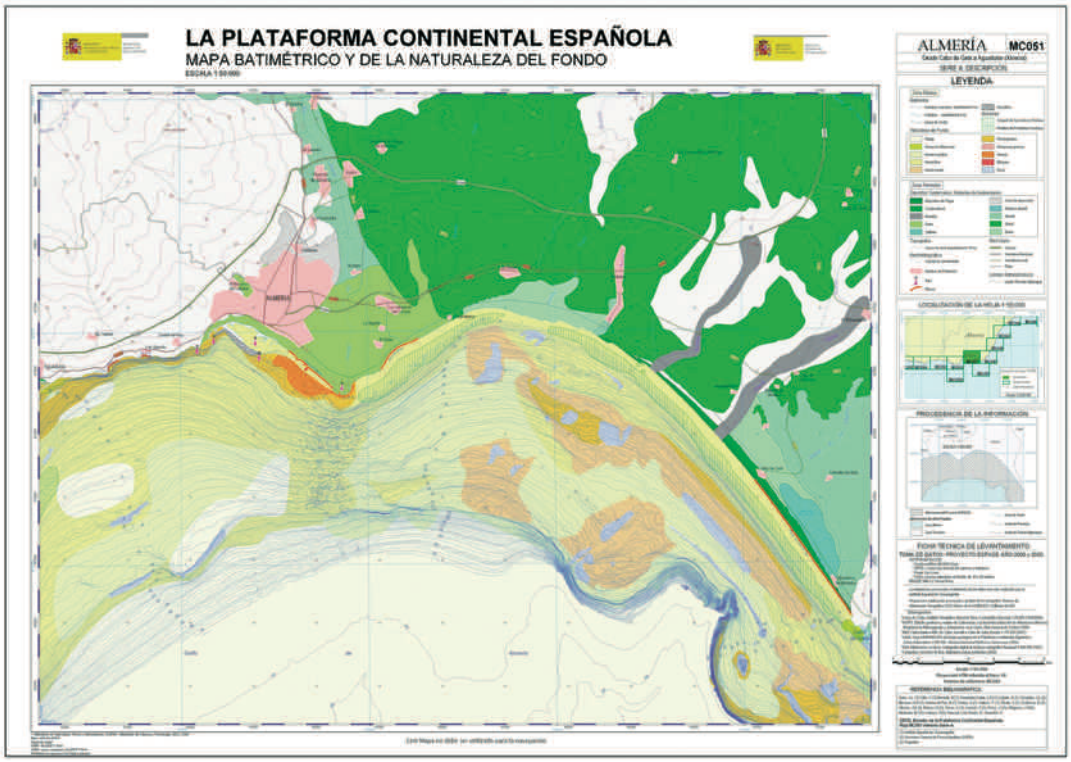
Corazón de María, 8
28002 Madrid-Spain
Phone: +34 91 3473619
Fax: +34 91 41355 94

The Spanish Institute of Oceanography (IEO), founded in 1914, is the oldest Oceanographic Research Institution in Spain. It develops cartographic activities basically through the marine geology department (Multibeam Cartography Group), where it is developing systematic cartographic projects of the Exclusive Economic Area and adjacent coastal areas.

SURVEY ABOUT SPANISH CONTINENTAL PLATFORM (ESPACE)

For a detailed information we recommend to visit:

http://www.ieo.es/ESPACE/descripcion_ESPACE.htm
http://www.ieo.es/ESPACE/proyectoESPACE.htm

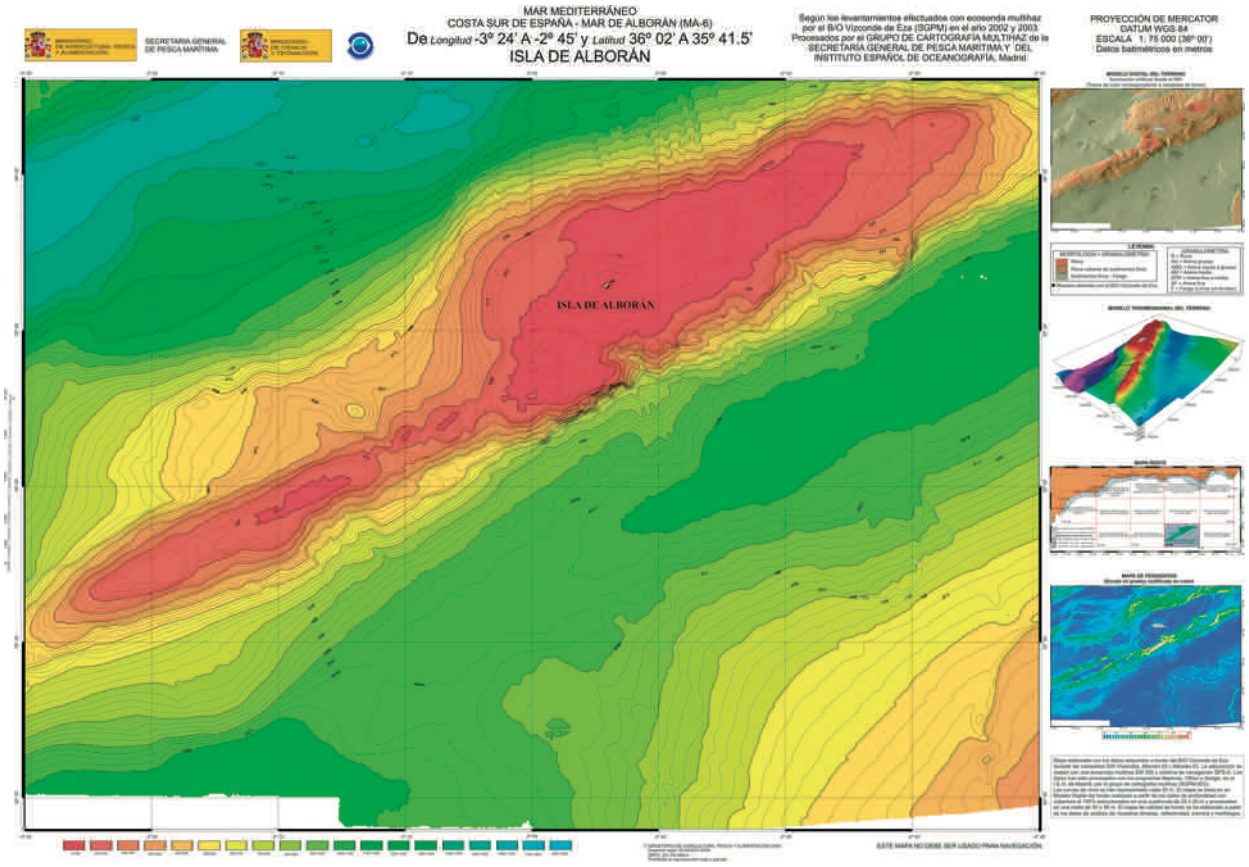


HYDROGRAPHIC AND OCEANOGRAPHIC SCIENTIFIC PROGRAM OF SPANISH EXCLUSIVE ECONOMIC ZONE (ZEE)

For a detailed information we recommend to visit:

http://www.ieo.es/zee/

FISHING CHARTS OF ALBORAN SEA

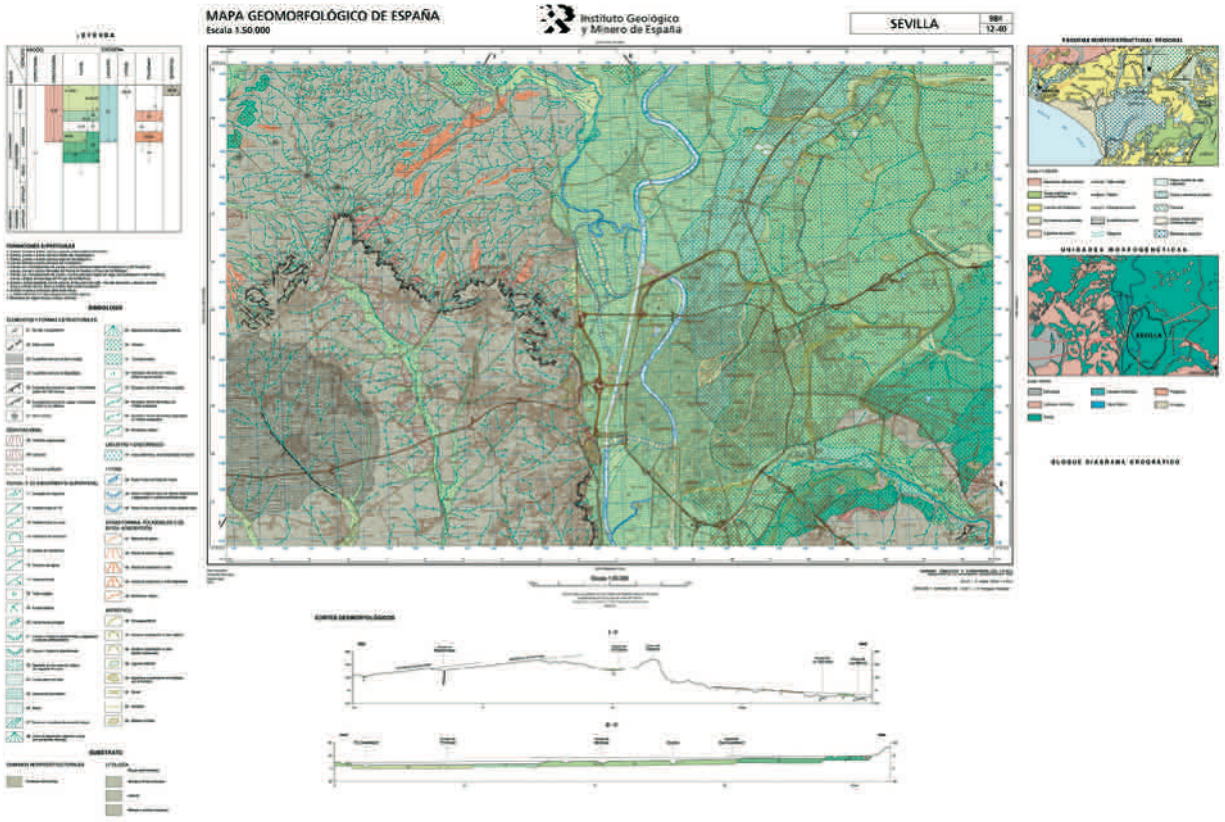


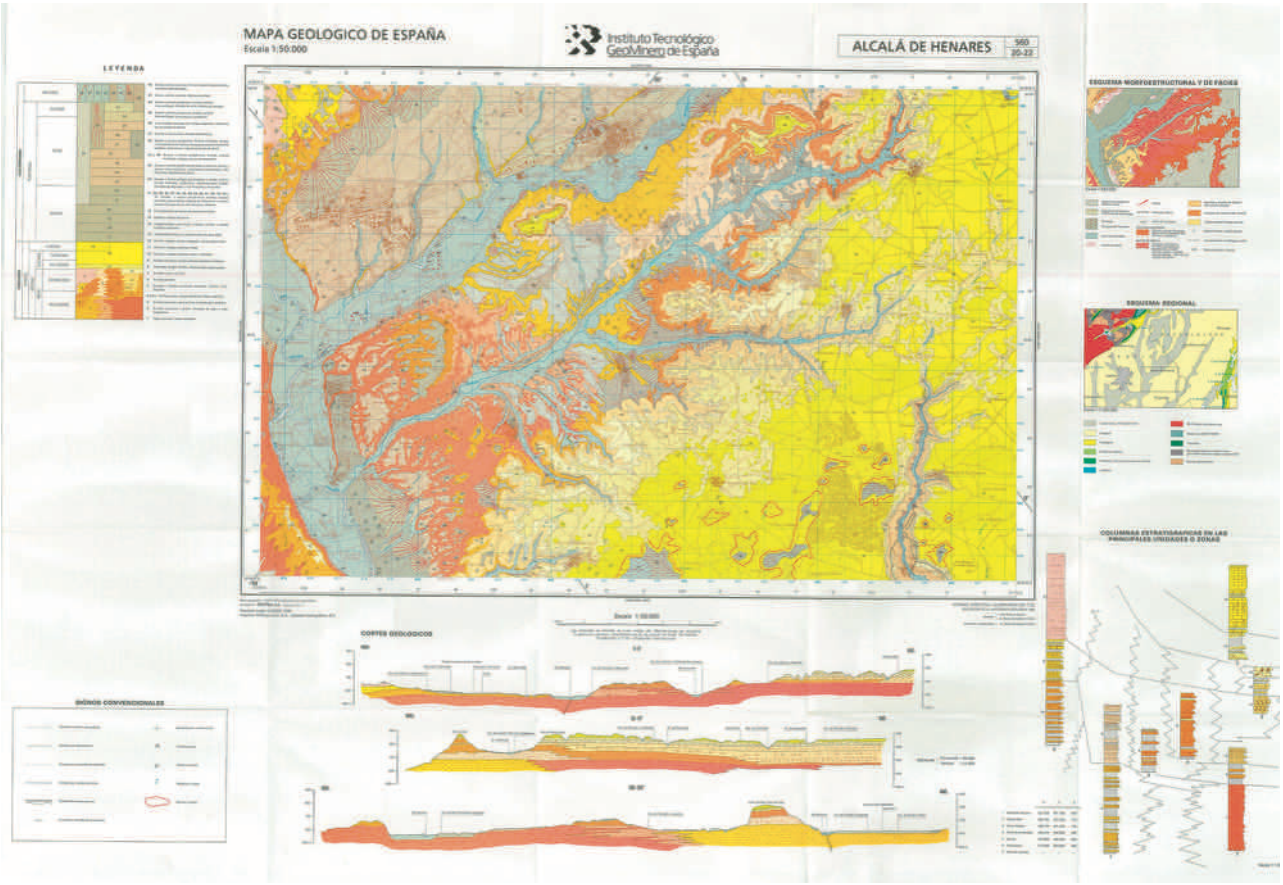
2.6. Technological and Geomining Institute of Spain

Rios Rosas, 4
28003 Madrid-Spain
Phone: +34 91 3495700
Fax: +34 91 4426216

The Geological and Mining Institute of Spain, published in the period 2005-2007 the following cartography:

– 26 sheets of the series Geological Map of Spain at 1:50,000 scale (with Geomorphological map and Memoir, Geological map).





- Geological Map of Fuerteventura Island at 1:100,000 scale.
- Geological and Geomorphological Map of Lanzarote Island at 1:100,000 scale.
- Geomorphological Map of Spain and continental margin at 1:1,000,000 scale.
- Metalogenetic Map of Cáceres and Badajoz at 1:200,000 scale.
- Metalogenetic Map of Extremadura at 1:250,000 scale.
- Hidrogeological Atlas of Cádiz.
- Geological Guide of Teide National Park.

2.7. Cadaster Management Center and Tributary Cooperation

Paseo de la Castellana, 272
28046 Madrid-Spain
Phone: +34 91 5836849

The Main directorate of the Cadastre is an independent department which belongs to the Ministry of Economy and Finance. It manages the Real Estate Cadastre in Spain, except in the regions of Navarre and the Basque Country which they have their own legal regimes.

The Spanish Cadastre covers a surface of 500,000 km^2, which supposes, approximately, 95 percent of the national territory.

The Spanish Cadastre is an administrative registry of universal and exhaustive nature. This means that the inscription of rustic or urban real estate, as well as the alterations that they might experiment, in it is compulsory.

The Spanish Cadastre also is characterized by its multiple applications, especially those of tributary nature, and also worthwhile mentioning its increasing use to guarantee the protection of property rights or to plan and manage the most varied public policies.

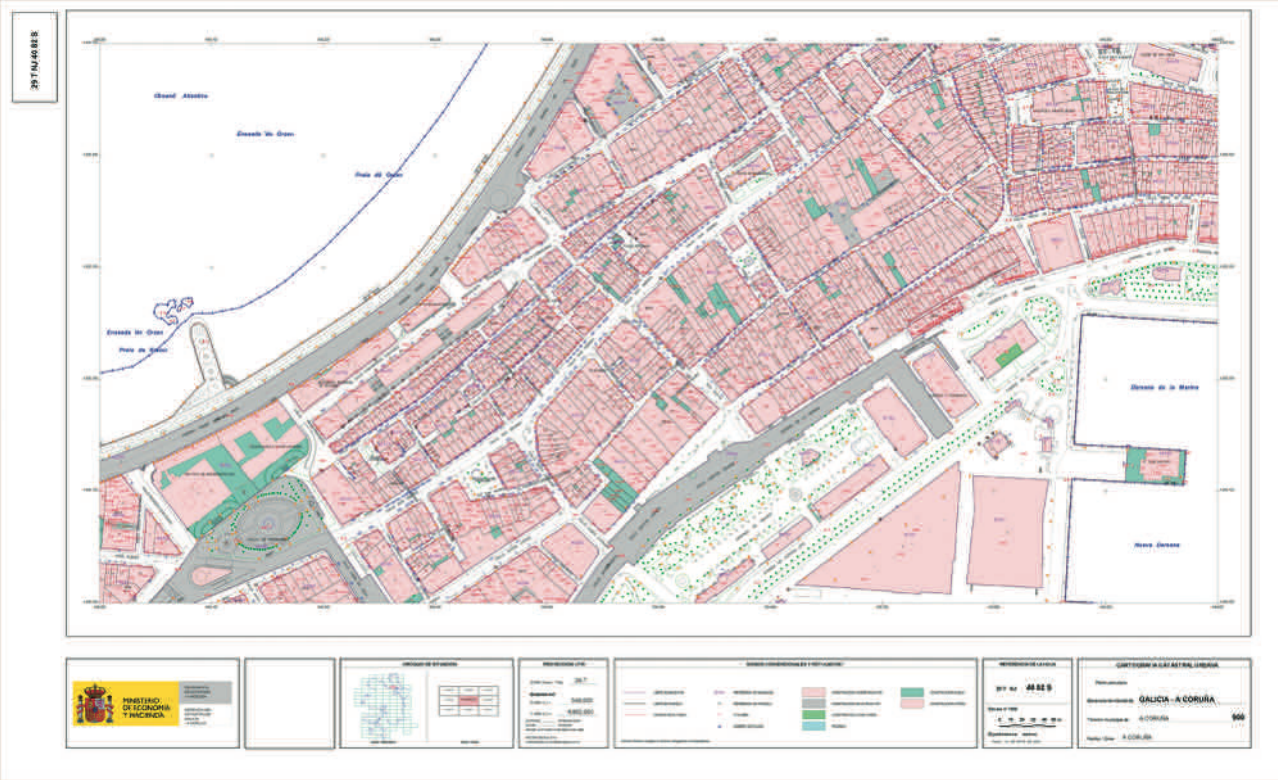
At present , about 74 million real estates are registered. The cadastre has physical, legal and economic data of each of them, like the surface, use, owner or value, as well as those data necessary for the unequivocal identification of the cadastral parcel, the unique alphanumeric code that is assigned to each of them, as well as its obligatory cartographic representation.

According to the Spanish legislation, the elaboration and management of the cadastral cartography is exclusive responsibility of the Directorate General for Cadastre, which can exert these attributions directly or by agreement of collaboration with other Public Administrations.

Its fundamental activities on cartography matter during 2003-2007 have been:

Completing the digitalization of all the cadastral cartography

By means of procedures related to massive updates of information or as a result of specific performances in cartographic issues, throughout 2007 the digitalization of the cadastral cartography of all the scope of the Directorate General for Cadastre will be completed. At present it is digitalized in its practical totality, which



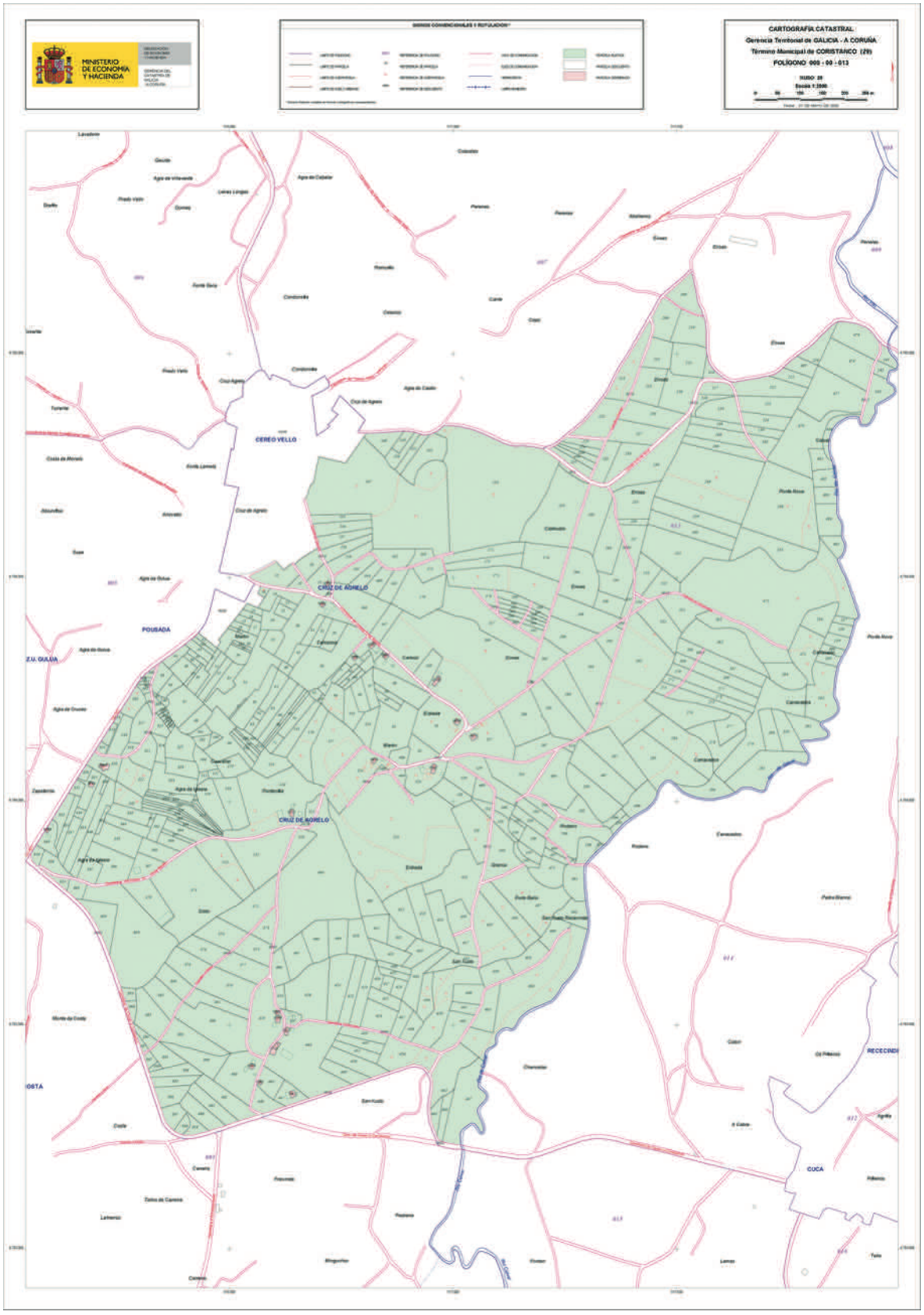
means having a cadastral cartography of a total of 32 million urban real estates (1,200,000 Ha) and 42 million rustic real estates (48,000,000 Ha), corresponding to 7,587 municipalities. The cadastral cartography has been obtained from ortophotography or by means of photogrametric flight and numerical restitution, being the scales of capture of 1:500 or 1:1,000 for the urban cartography and of 1:2,000 or 1:5,000 for the rustic cartography.

Development of new tools for the cadastral management of cartography

During these four years the corporative application SIGCA-2 for the cadastral management of cartography has been developed intensely, implementing numerous modifications for the improvement of consultation, edition and capture of information.

Facilitating the consultation and certification of cartography by means of the Virtual Office of the Cadastre

Since 2004 and by means of the Virtual Office of the Cadastre, available from the Web page of the Directorate General for Cadastre (www.catastro.meh.es), any citizen can look up, cost free, cadastral information and can get, also cost free, cadastral cartography. All data are updated daily. And copy of the information associated to a property using cadastral maps can be obtained, or a data certification of the parcel can be printed. Since May 2003, 185 millions maps have been downloaded.


MINISTERIO DE ECONOMÍA Y HACIENDA
CARTOGRAFÍA CATASTRAL
Gerencia Territorial de GALICIA - A CORUÑA
Término Municipal de CORISTANCO (ZI)
POLÍGONO 005 - 00 - 013
CEREO VELLO
CRUZ DE AGRELO
POUSADA
CUCA

So as to facilitate access to the cadastral information, cartographic and literal, since March 2005 about 2,500 Points of Cadastral Information have been installed in different Public Administrations, where the citizens can access, among other things, the digitalized cartography that the Virtual Office of the Cadastre offers, making this service more user-oriented and universal.

Advancing towards interoperability

The cadastral cartography is available in standard Web Map Service (WMS) since September 2005 for its consultation through different Spatial Data Infrastructures. Since then 35 million maps have been consulted.

Nowadays a pilot project to offer the cadastral cartography in standard Web Feature Service (WFS) and, consequently, to facilitate its unloading in vectorial format is being tested.

Participation in normative initiatives

Since 2003 the Spanish Directorate General for Cadastre has participated in different national and international work groups for the normalization of the procedures of generation of cartography and of availability of the information. Among them stands the participation of the Spanish Cadastre in the Permanent Committee of the Cadastre of the European Union, facilitated through Eurogeographics, in the implementation of the European Directive *Inspire*.

3. Regional Mapping Organization

3.1. Cartographic Institute of Catalonia
3.2. Cartographic Institute of Andalusia
3.3. Territorial Information System of Galicia. A Coruña Province Council

3.1. Cartographyc Institute of Catalonia

Parc de Montjuic
08038 Barcelona-Spain
Phone: +34 93 5671500
Fax: +34 93 5671567

The Institut Cartogràfic de Catalunya (ICC – Cartographic Institute of Catalonia) was created by Law 11/1982 of 8 October of the Parlament de Catalunya (Catalan parliament) as an autonomous commercial, industrial and financial institution of the Generalitat de Catalunya (autonomous government). On 11 June 1997, in accordance with Law 6/1997 passed by this parliament, it became a public corporation owned by the Generalitat de Catalunya. 8 years later, on 27 December 2005, the Catalan Parliament passed Law 16/2005 relating to geographic information and the Institut Cartogràfic de Catalunya, with the aim of updating the powers of the Institute and extending the regulatory framework from new perspectives.

It should be added that the Servei Geològic de Catalunya (Geological Survey), which the ICC took over in 1995, was created as an Institute by Law 19/2005.

Since it was founded, the ICC has brought a high degree of innovation and modernity to the cartographic studies and production undertaken in Catalonia; furthermore, it ensures that high-quality cartography is available to offer planning and support to a wide range of territorial initiatives. Its purpose, then, is to carry out the technical tasks involved in the development of cartographic and geological information.

Within this framework, the ICC undertakes cartographic projects of an official nature and of general interest to Catalonia, in addition to studies and projects commissioned or requested by both public and private organizations.

The activities of the ICC are planned and coordinated in accordance with a series of short and medium term productivity programs. This means that the initiatives in operation can be systematically monitored, while new projects may be added to the program.

The five principal areas of operation of the ICC are: cartographic production, geology and geophysics (until the year 2005), technological support and research, infrastructure, and training and research.

Below is a summary of the most important activities undertaken by the ICC in the period from 2003 to 2006:

CARTOGRAPHIC PRODUCTION

Topographic cartography

Continuous production of the first, second and fourth editions (second version) of the *Mapa topogràfic de Catalunya 1:5,000* (BT-5M) – topographic map – (4,274 sheets). As at December 2006, coverage of the 2nd edition had been completed and 964 sheets of the 3rd and 4th editions were available. Distribution: inkjet plotters, in digital format through the customer service centers, on the Internet and by means of the VisTopo viewing application.

Obtaining of ISO9000 certification for the line producing the BT-5M and derived products (MTC-5M and terrain elevation models).

Continuous production of the *Mapa topogràfic de Catalunya 1:10,000* (1, 121 sheets). In December 2006, coverage of the 1st edition was completed. Distribution: As for BT-5M, but excluding the VisTopo application.

Continuation of the special project *Base topogràfica de Catalunya 1:25,000* (304 sheets). As at December 2006, 100 sheets were available. Distribution: As for MTC-10M.

Continuous production of the *Mapa comarcal de Catalunya 1:50,000* – regional map – (41 sheets). As at December 2006, 15 sheets of the 4th version were available.

Completion of the *Mapa topogràfic de Catalunya 1:100,000* (7 sheets).

Publication of the 6th and 7th editions of the *Mapa topogràfic de Catalunya 1:250 000* and the 4th edition in relief.

Publication of several small scale topographic maps.

Large scale cartography

Continuous production of the large scale series for specific projects at 1:1,000 and 1:2,000 scales.

Continuous production of the special project *Mapa urbà de Catalunya 1:1,000*.

Orthophotographic and orthoimage cartography

Completion of the 4th version of the *Ortofotomapa de Catalunya 1:5,000* (4,274 sheets) – orthophotomap. In collaboration with the IGN within the framework of the National Aerial Orthophotography Plan 2004-2007. Distribution: inkjet plotters, in digital format through the customer service centers and on the Internet.

Commencement of ORTO-50M version 1. As at December 2006, 47 sheets were available. Distribution: by means of the VisOrto viewing application.

Commencement of version 5 of the *Ortofotomapa de Catalunya 1: 25,000* (304 sheets). This version is being produced from generalization of v.4 of ORTO-5M. As at December 2006, 166 sheets were available. Distribution: same as the *Ortofotomapa 1:5,000*.

Completion of the 1st version of the *Ortofotomapa de Catalunya 1:10,000* (ORTO-10M) (1 121 sheets).

Publication of the 4th edition of the *Mapa d'imatge satèl·lit de Catalunya 1:250,000* (satellite map).

Continuous production of orthophotographic and orthoimage cartography series for specific national and international projects, in addition to derived 3D products on CD-ROM (41 volumes of the project *Navegant per Catalunya*, commencement of the *Atlas virtual de Catalunya* and scenarios of the *comarques* of Girona).

Integrated Geodetic Positioning Service of Catalonia (SPGIC)

By the end of 2006, the utilitarian geodetic network of Catalonia contained 3 304 points.

By the end of 2006, the leveling network consisted of 2,539.4 km (1,611.7 km corresponding to the REDNAP network of the IGN and 927.7 km corresponding to the leveling network of Catalonia of the ICC).

Establishment of the reference stations of Sant Bartomeu del Grau, Mas Bover (Reus), Soriguera and Cassà de la Selva, bringing the total number of stations established to 13.

Commencement of 4 data distribution, code correction and phase correction systems (CatNet web, DGPS, CODCAT and RTKAT). The latter two through the use of virtual reference stations.

Commencement of the work to change the ED50 reference system to ETR89.

Thematic cartography

Publication of various small and large scale thematic maps: hiking, administrative, tourist, geological, vegetation, land use, road, fire maps, etc.

Atlases

Publication of 3 volumes on CD-ROM of the *Atles comarcal de Catalunya* collection – regional atlas (Alt Empordà, Garrotxa, Pla de l'Estany).

Geographic and thematic databases

Maintenance of databases: land use, toponymy, elevations, ground control, administrative boundaries, road information and transport, streets.

Completion of loading elevation models into the Elevations database of Catalonia v.2.

Continuation of the special project "Catalan rural land registry".

Continuation of the special project "Delimitation of the maritime-terrestrial public domain".

Laser altimetry applications

Continuation of the special project "Planning of river areas of Catalonia (PEFCAT)".

28 projects have been undertaken with the laser altimeter.

Photogrammetric flights

Acquisition of the Cessna Caravan 208B airplane.

Acquisition of two Zeiss DMC digital photogrammetric cameras.

Undertaking of various flights to cover specific objectives: planning, roads, towns and villages, in addition to municipal and urban cartography outside Catalonia.

Undertaking of multispectral flights and flights with the laser altimeter.

The total number of flights made in the period 2003-2006 was 709.

The total number of hours flown in the period 2003-2006 was 2 580.

Territorial boundary marking

Technical advice for the Direcció General d'Administració Local (Local Administration Head Office) and preparation of the delimitation proceedings and certifications for private parties and municipal councils.

Continuation of the special project "Municipal boundaries of Catalonia".

Geology and geophysics

From 2006, operations in this field were transferred to the Institut Geològic de Catalunya (with the exception of the production outlined hereunder).

Geology

Continuation of the special project "*Mapa geològic de Catalunya 1:25,000*" – geological map – with continuous production of the map (301 sheets). As at December 2006, 37 sheets were available.

Publication of the *Mapa geològic comarcal de Catalunya 1:50,000* (41 sheets). As at December 2006, 29 sheets were available.

Completion of the *Mapa de zones d'allaus de Catalunya 1:25,000* – avalanche zones – (14 sheets).

Technological support and research

Photogrammetry and geodesy

Commencement of the determination of the GeoCat2003 model of the geoid of Catalonia.

Improvements to the operation of the GEOMOBIL system.

Incorporation of the ICCProjectManager tool into the automatic generation of stereopairs.

Implementation of the Calibration certificate database.

Improvement of the automatic mosaic in the generation of orthophotos.

Generation of new tools for orientation of the images captured with the digital photogrammetric camera.

Completion of version 1 of the GAST software.

Integration of version 5.0 of the Match-AT software into the production line.

Cartographic edition

Implementation of the applications for the distribution of the *Base topogràfica de Catalunya 1:25,000* and completion of its data dictionary.

Generation of PDF printing files of the topographic maps 1:5,000 and 1:25,000.

Improvement of the sheet extraction, cover generation and editing applications for cartography projects at 1:1,000 scale.

Improvement and migration to Windows XP and MicroStation-J of the MTC-10M and BT-25M production applications.

Information systems

Incorporation of new data sets into the corporate geospatial database.

Development of GIS applications for internal and external projects.

Remote sensing and image processing

Design of an algorithm for adjustment of multiple SAR interferograms.

Integration of the laser into the GEOMOBIL system.

Establishment of the methodology to correct the atmospheric effects on images obtained by the CASI airborne sensor.

Undertaking of various projects to automatically obtain thematic and land use information, and LIDAR application projects.

Completion of the project to combine LIDAR data and Quickbird multispectral images.

Pilot test with an airborne laser bathymetric system.

Infrastructure

Distribution of cartographic products

Introduction of the new policy to circulate digital database products of the ICC free of charge.

In the period 2003-2006, the total number of downloads of digital cartography via the Internet was 854 800.

The number of requests for digital cartography from the customer service centers was 13,735.

Maintenance of the ICC website and incorporation of new content, new applications and new design. During the period 2003-2006, the web received 2,914,692 visits.

The main cartographic series produced by the Institute can be viewed and downloaded free of charge from the ICC website.

Incorporation of the GeoServices into the ICC web site.

Map Library

Continuous increase of the resources of the Catalonia Map Library (288,354 maps; 40,657 books, 3,235 journals; 40,082 photographs and 17,600 microforms).

Continuation of the special project "Digitalization of the historical cartography resources of the Map Library". By December 2002, 204 maps had been scanned.

Spatial Data Infrastructure of Catalonia

Continuation of the special project "*Infraestructura de Dades Espacials de Catalunya (IDEC)*" - Spatial Data Infrastructure of Catalonia.

Documentation center

Maintenance of the graphic catalogue (SIFOTO) and alphanumeric catalogue (FOTOPACK) of the Aerial Photo Library.

Total number of vertical aerial photography photograms: 555,232 (both digital format and polyester).

Calculation infrastructure

Enlargement of the technological infrastructure of the computer center storage area.

Training and research

Undertaking of experimental projects related with internal development topics and programs.

In the period 2003-2006, 194 communications were presented at national and international congresses, and 76 articles were published in national and international publications.

Continuous publication of books and periodic institutional publications designed to publicize the ICC's activities or to complement the information about specific cartographic products.

ORGANIZATION OF INTERNATIONAL EVENTS

II Theoretical and practical training course on advanced cartographic techniques: Spatial photogrammetry. Organized by the ICC with the collaboration of the Instituto Geográfico Nacional and the Centro Geográfico del Ejército (within the framework of DIGSA). Barcelona, February 2003.

AAPG International Conference and Exhibition. Organized by the American Association of Petroleum Geologists and the ICC. Barcelona, September 2003.

Course on digital photogrammetric processes. Organized by the Instituto Nacional de Estadística, Geografía e Informática (INEGI) and the ICC. Aguascalientes (Mexico), November 2003.

III Theoretical and practical training course on advanced cartographic techniques: Publication of cartography with digital techniques. Organized by the ICC with the collaboration of the Instituto Geográfico Nacional and the Centro Geográfico del Ejército (within the framework of DIGSA). Barcelona, May 2004.

IV Mountain cartography workshop. Organized by the International Cartographic Commission on Mountain Cartography (ICA/ACI). Vall de Núria, September-October 2004.

Traveling exhibition "Historical evolution of the cartography of the Pyrenees". Organized by the ICC within the framework of the Comunitat de Treball dels Pirineus. Display of 50 reproductions of maps of all or parts of this mountain range, covering a period from the 14th century to the present day. Seu d'Urgell, Andorra, Aquitanie, Aragon, Catalonia, Languedoc-Roussillon, Midi-Pyrénées, Navarre and Basque Country (1 month per region), September 2004-May 2005.

"1.ª Jornada Tècnica de Neu i Allaus". Organized by the ICC with the collaboration of the Servei Meteorològic de Catalunya, ACEM, Universitat de Barcelona and Xarxa Temàtica de Riscos Naturals. Barcelona, June 2004.

Electronic Cartographic Materials Cataloging and Metaloging, a course given by M. L. Larsgaard, Assistant Head of the Map and Imagery Laboratory, Davidson Library, of the University of California (Santa Barbara, USA), within the 2nd series of lectures of the Catalonia Map Library "Map libraries in the 21st century". Organized by the ICC and Consorci de Biblioteques Universitàries de Catalunya with the collaboration of the Universitat Autònoma de Barcelona. Barcelona, November 2004.

Cartography and geographic information systems (GIS), corresponding to the first module of technical assistance provided by the ICC for the Central Bureau of Statistics (CBS) of the National Planning Commission of the Republic of Namibia. Organized by the ICC with the collaboration of the Universitat Autònoma de Barcelona (Geographic Information and Remote Sensing Laboratory, LIGIT), Universitat de Girona (GIS and Remote Sensing Service, SIGTE) and Universitat Politècnica de Catalunya (Fundació Politècnica de Catalunya, FPC). Windhoek (Republic of Namibia), November 2004.

IV Theoretical and practical training course on advanced cartographic techniques: Generation of orthoimages and their use in land registries. Organized by the ICC in collaboration with the Instituto Geográfico Nacional and the Centro Geográfico del Ejército (within the framework of DIGSA). Barcelona, February 2005.

Cartography and geographic information systems (GIS), corresponding to the second, third and fourth module of technical assistance provided by the ICC for the Central Bureau of Statistics (CBS) of the National Planning Commission of the Republic of Namibia. Organized by the ICC in collaboration with the Universitat Autònoma de Barcelona (Geographic Information and Remote Sensing Laboratory, LIGIT), the Universitat de

Girona (GIS and Remote Sensing Service, SIGTE) and the Universitat Politècnica de Catalunya (Fundació Politècnica de Catalunya, FPC). Barcelona and Girona, 2005.

V Theoretical and practical training course on advanced cartographic techniques: Integrated geodetic positioning systems. Organized by the ICC in collaboration with the Instituto Geográfico Nacional (within the framework of DIGSA). Barcelona, June 2006.

AWARDS AND HONORARY MENTIONS

The Official Committee of the International Cartography Association (ICA/ACI), in the course of the 21st International Cartographic Conference held in Durban (South Africa, August 2003), gave an award to the ICC for the European-Seismic Hazard Map 1:5,000,000, in the scientific maps category (map published by the ICC in collaboration with the Swiss Seismological Service, the Institut Jaume Almera of the CSIC, the European Seismological Commission and the International Geological Correlation Program).

The Generalitat de Catalunya (autonomous government) presented the ICC with the "Narcís Monturiol" Award for merit shown in the field of science and technology. October 2003.

The Official Committee of the International Cartography Association (ICA/ACI), in the course of the 22nd International Cartographic Conference held in La Coruña (Spain) in August 2001, gave an award to the ICC for the *Mapa de relleu submarí de Catalunya 1:250,000* (Submarine Relief Map of Catalonia), in the "Others" category.

Mr. J. L. Colomer, Technical Deputy Director of the ICC, was named Honorary Fellow of the International Cartographic Association in recognition of his outstanding contribution to cartography. The certificate was presented to him by the Executive Committee of the ICA/ACI during the 22nd International Cartographic Conference held in La Coruña (Spain) in July 2005.

3.2. Cartography Institute of Andalusia

Consejería de Obras Públicas y Transportes
Junta de Andalucía
Patio de Banderas, 14
41004 Sevilla-Spain
Phone: +34 955057600 - Fax: +34 954219024

The Institute of Cartography of Andalusia, in the Territorial Department of the Andalusian Government, is the organism entrusted of the production of the cartographic necessary bases in order to know the Andalusian territory. From their creation it carry out works of coordination in this matter and a permanent activity in the contents and representation of the cartography of Andalusia, competitions and functions reinforced by the Ordinance 141/ 2006 of 18 of July.

This last Ordinance is approved in order to ordering the cartographic public activity, inside the competencies of the Autonomous Community of Andalusia, concerning to production, coordination, cooperation, use and diffusion. The Ordinance has been structured in four chapters: the first is dedicated to general aspects, the second to the ordination of the organization of the cartographic function in the Andalusian administration, the third to the establishment of the instruments of coordination, cooperation and participation and the fourth to the basic elements of the Spatial Data Infrastructure of Andalusia.

The Institute of Cartography of Andalusia facilitates support to the Autonomous Administration in the ordination of the territory, town planning, infrastructures, as well as in other sectors: agriculture, environment, culture, emergencies, etc. To other administrations, especially to the Andalusian Local Corporations they support in the general planning, street maps, etc., and in general, to the citizens in technical works and a better knowledge of their territory.

Andalusia update their basic cartography to territorial scales periodically (1:10,000 1: 5,000) and urban (1:2.000, 1:1,000 1:500), as well as their corresponding photogrametric flights. With their geographical extension it makes that it is one of the Autonomous Spanish Communities with more cartography of their territory.

The updating of that cartography in harmony with the necessities of the Government of Andalusia, the execution of the vocation of public service, the adaptation of the production and diffusion of the cartography to the new technological advances and the adaptation of the European and national guidelines, they are permanent objectives in the programming of the Institute of Cartography of Andalusia.

Following is exposed the main plans and programs developed between 2003 and 2007.

PHOTOGRAMETRIC FLIGHTS

Along these years It have been carried out diverse photogrametric flights, territorial and urban, for the elaboration and updating of the different cartographic series and ortophotos, as well as for other diffusion projects.

Photogrametric Territorial Flights

In 2004, by an agreement with the Cartographic Institute of Catalunya, they carried out the following flights:

- 1: 60,000 (colour) of all Andalusia, for the updating of the digital Ortophoto of Andalusia (colour), with 1 meter resolution.
- 1:18,000: 200,000 hectares corresponding to the Metropolitan Area of Seville and the coast of Cadiz and Huelva, for the realization of the Topographical Map of Andalusia to scale 1: 5,000 in vectorial format.

In 2005 it was carried out the flight to scale 1: 20,000 (Infrared colour) of approximately 1,900,000 hectares, corresponding to the fourth N.E. of Andalusia, for the updating of the digital Ortophoto of Andalusia in white and black, with resolution 0.5 meter.

Now is carrying out two flights: one with a GSD of 28 cm. of the quadrant SW of the Autonomous Community of Andalusia, and another of the entirety of the Andalusian territory with a GSD of 90 cm.

Photogrametric Urban Flights

For the realization and updating of the urban cartography has carried out the following flights:

- Flights to scale 1: 5,000: 44 towns in 2003, 45 in 2004, 47 in 2005, 141 in 2006 for the realization of urban cartography to scale 1: 1.000.
- Flights to scale 1: 8,000: 130 urban nuclei in 2003, 151 in 2004, 182 in 2005, 253 in 2006 for the realization of urban cartography to scale 1: 2,000.

This cartography is made at the request of the city council that requests it for their works of planning.

ORTOPHOTOS AND DIGITAL MODELS OF THE LAND (DTM)

In 2003 it was carried out the edition and distribution of the Digital Ortophoto of Andalusia (colour) derived of the flight to scale 1: 60,000 carried out from 1998 to 1999.

In the agreement of collaboration signed in 2001 with the Consejeria of Agriculture and Fishing and the Consejeria of Environment for the realization of ortophotos bases of Andalusia, between 2003 and 2007, the following works have been carried out:

- Finalization and edition in eight provincial DVDs in MrSID format of the digital Ortophoto of Andalusia in white and black with a resolution of 0,5 meters, from a flight in white and black to scale 1: 20,000 (2001-2002).
- Updating of 700.000 hectares of the Digital Ortophoto of Andalusia in white and black with resolution 0.5 meters, starting from a flight carried out by the Consejeria of Environment in 2004, corresponding to the quadrant SE of Andalusia, affecting to the provinces of Almeria and Granada.
- Realization and updating of the Digital Ortophoto of Andalusia (colour), with resolution of 1 meter, starting from the flight of Andalusia 1: 60,000 (2004).
- Updating of 200.000 hectares of the Digital Ortophoto of Andalusia in white and black with resolution 0.5 meters, starting from a flight of 2005 corresponding to the quadrant NE of Andalusia.
- Realization of the 8,000 Km^2 of the satellite Ortophoto of the Coast of Andalusia starting from images of the satellite QUICKBIRD, in collaboration with the D.G. of Urbanism, to be used in the «Program of urban control of the coast.»
- Edition of the Digital Territorial Model of Andalusia in DVD, starting from aerial pictures to scale 1:20,000, containing an application of visualization and a Digital Ortophoto of Andalusia to half resolution.

In 2007 It is going to be elaborated a colour Ortophoto 1: 60,000 of the Andalusian territory. Also, The Institute is working in collaboration with the Consejeria of Environment and Consejeria of Agriculture and Fishing in the edition of an ortophoto of an American Flight on the Spanish territory done between 1956 and 57.

BASIC TERRITORIAL CARTOGRAPHY

Cartography to scale 1:10,000

Between 2003 and 2004 is concluded the second plan of updating (1999-2004) of the Topographical Map of Andalusia to scale 1: 10,000 (MTA10), with the realization of 1,039 sheets corresponding to 3,189,016 hectares of the provinces of Almeria, Cordoba, Granada and Jaen.

In parallel the vectorization of the MTA10 was carried out, being nowadays available a complete and continuous cartography of the Andalusian territory in diverse formats (shp, dxf, etc).

Cartography to scale 1:5,000

In 2004 the second updating plan (1999-2004) is concluded of the Topographical Map of the Coast and Metropolitan Areas to scale 1:5,000 (MTA5) with the realization of 107 leaves corresponding to 76,000 hectares of the coast and urban masses of Almeria, Cordoba and Granada.

Also, the digitalization in raster format of this cartography is continued, publishing it in 2004, in DVD support, the last version, modernized to 2,000, of the coast of the provinces of Huelva, Cadiz and Malaga, with a content of 518 sheets in raster format colour, equivalent to 4,400 km^2, and an application of visualization.

Andalusia Base Map

At the moment the Institute is working in the model of data and in the capture of information of the Andalusia Base Map (MBA) a base cartographic vectorial that will become the reference of the topographical cartography of Andalusia.

BASIC URBAN CARTOGRAPHY

The urban cartography is elaborated fundamentally in order to assist the demand of town planning of the municipalities. Between 2003 and 2006 has been carried out 277 towns to scale 1:1,000 and 716 to 1:2,000, being their distribution for province and year the following:

GEOGRAPHICAL NAMES

In 2004 It began the elaboration of the data base of Geographical Names (BTA10), a base from complete and homogeneous names of all Andalusia which pretend to be the reference for the productions of the Institute of Cartography of Andalusia for the Autonomous Administration and all the citizen.

At the moment it have been ended the first version of the BTA10 and it have adapted to the Spanish Model of Nomenclature.

ANDALUSIAN POSITIONING NET (RAP)

In 2004 begin a new line, pioneer in the European context, consisting in a service of active geodesic using GPS, The Andalusian Positioning Net. It Consist in a net of 22 stations, 2 mobile teams and a centre of control that will lend services of correction through UHF, FM, GPRS and Internet.

In 2005 the installation of the first order net was completed and it includes the assembly of nine stations, one for each province capital and another in Algeciras. The Control Centre, installed in the Laboratory of Astronomy and Geodesy of the Faculty of Sciences of the University of Cadiz, have carried out the first tests of setting in progress of the net.

In 2007 the net is going to start working covering the entirety of the Andalusian territory. The new service of positioning offered by the RAP will permit the creation of a geodesic frame of unique and stable reference for cartographic and topographical risings, offering services of discharge of files of RINEX observations (FTP service) and of positioning in real time (RTK services, RDS, GSM and IP).

SPATIAL DATA INFRASTRUCTURE OF ANDALUSIA (IDEANDALUCÍA)

In 2004, after the phase of design coordinate by the Geomatic Commission of the High Board Superior Geography, it began the implantation of the Spatial Data Infrastructure of Andalusia. It have been proceeded to

the documentation of metadatas of the digital production of the ICA (territorial cartography, urban, flights, etc.), It have been selected and adapted a computer application to load metadatas and have been designed the geoportal of the IDEAndalucía with an agreement with the ICC.

In 2005 were settled the necessary hardware and software for the geoportal that includes a server of maps in Internet, a metadata manager and a data base (Oracle). It have been proceeded to the redesign of the geoportal to adjust it to the directive of accessibility.

EVALUATION OF QUALITY

Throw an agreement with the University of Jaen, between 2004 and 2005 was carried out a project of statistical evaluation of parameters of quality, in order to obtain precise and quantified metadatas of the products of the ICA. This project has allowed documenting the levels of quality in the infrastructure of spatial data, advance in the elaboration of technical norms and in the establishment of new strategies of production.

THEMATIC AND DERIVED CARTOGRAPHY

Guide Maps of Natural Parks

From this series, initiate in 1990, have been made maps in collaboration with the Consejeria of Environment. It has been published about 20, with an edition between three and five thousand copies.

Medium Towns Streets Maps

The elaboration and edition of street maps of cities with an historical, tourist or geographical interest is a line that began in 1995, being of great utility to local level for the citizens and for the own administration for the knowledge that provides.

They, from 2003, have been published about twenty streets maps. In all the cases the collaboration of the respective city council has been had, that they have facilitated the information required on names, singular buildings and other aspects. The edition of each map is between three and five thousand copies.

Road Maps

In 2006 the 3rd edition of the Official Road Map of Andalusia, conformed by a regional map was published 1: 400,000 and 8 provincial maps 1: 200,000.

Now the Institute is working in an interactive Guide of roads in CD-Rom, whose edition will be in 2007. This guide includes an application that will permit the measure of distances, the calculation of routes, the search of names, the administration of layers of information and the visualization in 3D.

General Maps of Andalusia

Relief Map of Andalusia 1:500,000

In order to disclosing the territorial image of Andalusia in their fundamental aspects (towns, roads, relief, rivers) it have been carried out a modernized edition in 2005, so much in their content like in their aesthetic characteristics, of the Map of Andalusia in relief to scale 1:500,000.

Topographical map of Andalusia 1:100,000

This map had a digital edition of 1999 already out, for what it have been proceeded to their updating in 2004. It have been demanded datas to the Consejeria of Environment, Agriculture and Fishing, Health, Culture, Education, Innovation and Economy and Finance and at the same time ICA has developed new layers, obtained by generalization of the MTA10v. These series of data have been integrated in a new model of data, documented in their metadatas and accompanied by an application of visualization.

Reference Boundaries

Out the two previous editions, it have been carried out a new edition with data modernized to 2004, incorporating to the countries, regions and municipalities another new administrative levels like the districts and the local autonomous entities. This edition has been distributed to all the directive centres of the Government of Andalusia in order to assure the use of some administrative common references.

Cartography of the metropolitan environments of Andalusia

In 2006 it has begun a new series of cartography of 9 big metropolitan areas of the Community Autonomous of Andalusia. Their content presents a topographical cartography of the environment in question and an ortophoto.

Didactic and educational Material

Maps to learn Andalusia

In 2005 a summary of silent maps of the region devised like didactic resource for the teaching of the geography in the educational centres of primary and secondary has been published. These maps are facilitated to the centres in paper format for their reproduction and in digital for their impression and distribution between the students.

Playing with the Maps

Publication oriented to children that allows knowing and learning the main features of the Andalusian geography through different games.

The Cartography in Andalusia

Publication that picks up the principles and general foundations of the several fields that it embrace the cartography, as well as the main lines of work, products and services of the Institute of Cartography of Andalusia.

The Cartography: a world to discover

It is Audiovisual where you made a journey around the history of the cartography and their foundations, their basic applications and the work of the Institute of Cartography of Andalusia.

At the beginning of 2007 took place the 1º Competition of infantile drawing «Andalusia in a map» with almost 500 works of more than one hundred of educational centres of the region.

Also, in the programming of 2007, is going to be edited a Digital Map of Andalusia that will permit the scholars make their own cartography of the region, the publication of a new Interactive Atlas of Andalusia and the preparation of a basic Atlas of the region adapted for blinds.

ATLAS OF ANDALUSIA

In 2005 was published, in collaboration with the Consejeria of Environment, the II volume of the Atlas of Andalusia that picks up a wide summary of environmental cartography to scale 1:400,000, with 18 maps that contribute to a better knowledge of the environmental patrimony and of the natural resources of the Autonomous Community.

In 2007 a version modernized of the I Volume on general cartography has been reissued (1:100,000). With this finish a great project editorial that has supposed a great effort of summary, integration and public diffusion of the geographical available information on the Andalusian territory.

HISTORICAL CARTOGRAPHY

Between 2003 and 2004 was classified more than 13.405 maps of files of Malaga: (Archive of the Department of Mines of the Provincial Delegation of the Consejeria of Innovation, Science and Company; Archive of the Port Authority, Historical Municipal Archive, Headquarters of Road of Malaga of the Ministry of Development and of the Rustic Cadastre of the Provincial Delegation of Finance of Malaga).

In 2005 6.000 maps of the Historical Provincial Archive from Granada were classified and of the Foundation of Spanish Railroads (Madrid) and there is been scanned maps of the Provincial Unit of Malaga of the Geographical National Institute.

In 2004, continuous a series begun in 1995, the Catalogue of Historical Cartography of the province of Seville was published, being in realization the corresponding to the province of Malaga. Also, it is working in the edition of a series of interactive catalogues of historical cartography of each province.

In 2007 has been published in collaboration with the Geographical National Institute «Cartography of a century: Andalusia in the first edition of the Topographical National Map 1:50,000,» a work of cartography of the Andalusian territory.

In this same line, the Institute is working in the summary of a cartography from Spain 1:50,000 elaborated by the German government before the II World War.

DIFFUSION

Internet

The web page has become the main ICA products diffusion channel, so the Institute is making a special effort in order to renovate their contents and maintain modernized the connections, convoking, inventories and documents.

In 2004 it was incorporated to the site the following new pages:

- Searcher of historical maps: Data base of 110.000 historical maps with an application on line.
- Searcher of maps and air pictures.
- Reviews of geodesic vertexes.
- Viewer 3D: sailing on a model of elevations with ortophotos, in collaboration with the Consejeria of Education.

In the page also appears a version of the Atlas of Andalusia and the Catalogue of products that have been updated to 2007 and translated into English.

Conferences, seminars and exhibitions

The Institute of Cartography of Andalusia has participated or organized different technical forums and seminars. Following are the main ones:

2003:

- Expogeomática. Mapping. Seville.
- Exhibition of cartography in the Faculty of Philosophy and Letters of the University of Granada.

2004:

- Expogeomática. Mapping. Seville.
- Forum TIG-SIG 2004. ICC. Barcelona.
- Territorial and Urban Techniques in Andalusia. Diputacion of Cadiz.
- Quantitative Methods, SIG and remote sensing. AESIG. Murcia.

— Fair of the Construction. Seville.
— Technical Days of Spatial Data Infrastructures of Spain (JIDEE). Zaragoza.

2005:

— Conference and International Exhibition of Cartography. A Coruña.
— Exhibition: Cartography and Geomática: a service for the society of the information. University of Jaen.
— Technical Days of Spatial Data Infrastructures of Spain (JIDEE). Polytechnic University of Madrid. ETSI Topography, Geodesy and Cartography. Madrid.

2006:

— XII National Congress of Technologies of the Geographical Information. Celebrated in Granada.
— Exhibition: «The maps and the territory: technical and advances in their representation.» University of Granada.

2007:

— Meeting of the Work Group of Spatial Data Infrastructures of Spain. Seville.

FORMATION

The Institute of Cartography of Andalusia has organized or sponsored a series of formative activities between 2004 and 2006 consistent in the following technical days and courses.

2004:

— SIG ArcGIS v8. Seville 19-23/ 04/ 2004
— PhotoShop v7. Seville 8-11/ 03/ 2004

2005:

— Workshop of Lidar. Seville 25/ 07/ 2005.
— The Topography and cartography of Andalusia. In collaboration with the Official School of Technical Engineers in Topography. Seville 03/ 06/ 2005.
— Cartography and SIG. In collaboration with the IAAP. Seville 26-30/ 09/ 2005.
— Introduction to the GPS. In collaboration with the IAAP. Seville 17- 19/ 10 2005.
— PhotoShop v7 Advanced. In collaboration with the IAAP. Seville 7-11/ 11/ 2005.
— SIG ArcGIS v8. In collaboration with the IAAP. Granada 14-17/ 11/ 2005.
— Workshop of diferencial Interferometry 15/ 11/ 2005.
— Technical Day: Cartography and Geomática: a service for the society of the information. In collaboration with the University of Jaen. 21/ 11/ 2005.

2006:

- II Technical Workshop on Topography and Cartography of Andalusia 12/ 05/ 2006.
- Presentation of the IDEUnivers Project 15/ 11/ 2006 inside the program Interreg IIIb MEDOCC of the European Union, it have begun a project denominated IDEUnivers in which the Institute participate in collaboration with several organisms from Catalonia, Italy and Greece. The objective of the project is advice and form the universities and centres of investigation in the elaboration of a geoportal in order to expose and diffuse their works related with the spatial information and in order to impel the elaboration of the metadatas.
- Introduction to the family of ISO Norms 19100 on geographical information 23/ 11/ 2006.

2007:

- Microstation In collaboration with the IAAP 26-30/ 03/ 2007.
- SIG ArcGIS v9. In collaboration with the IAAP. 7-11/ 05/ 2007.
- Spatial Data Infrastructure (SDI). In collaboration with the IAAP 21-24/ 05/ 2007.

3.3. Territorial Information System of Galicia. A Coruña Province Council

DIGITAL MAPPING AT DIPUTACIÓN PROVINCIAL DE A CORUÑA (A CORUÑA PROVINCE COUNCIL)

As shown in the figure, since 1990, the department of Technical Advisory to Municipalities (SATM) from Diputación Provincial de A Coruña (from now on: DPC), has been experimenting with the incorporation of digital geographical information, understanding that new information technologies (IT) would facilitate the tasks of dealing with territorial data.

GIS TECHNOLOGIES USE EVOLUTION AT DPC

First steps where merely temptative, and by making use of other producers low scales base mapping in order to support the adding of our own low resolution thematical data. This way, a series of choropleth maps showing the state of infrastructures and services at municipal level were produced.

In a second step, and still using mid scale digital base mapping (1:25,000, 1:50,000) from national Spanish mapping organization (IGN), a new product was launched: the so called "*Inventario Cartográfico de la Red Viaria Local de la Provincia*" (in English: "*Mapped Inventory of Local Road Network within the Province*").

Finally, and within the updating works of EIEL, which is the Spanish acronym of *Enquiry on Local Infrastructures and Services*, the decision was taken of building up a territorial data base (BDT-EIEL) containing high resolution information (up to 1:1,000) at a municipal level dealing with those matters. The goals were:

Taking advantage of GIS tools to manage, maintain and making use of the territorial information contained within BDT-EIEL, and

Facilitating the re-use of this information by municipalities of the province

Both goals were actually achieved and, particularly the second one, even overpassed, as BDT-EIEL was finally published in the Internet (www.dicoruna.es/webeiel/) and opened to general users, not just to municipalities' staffs.

As a consequence, currently DPC publishes thematic and choropleth mapping related to:

- Demography, housing and urban planning.
- Roads network.
- Street network.
- Water supply.
- Sewerage network.
- Domestic waste materials disposal.
- Street lightning.
- Power and gas supply.
- Communication services.
- Sports facilities.
- Education.
- Health care services.
- Social services.
- Cultural premises.
- Markets and fairs.
- Cemeteries.
- Other public services.
- Municipal owned buildings.
- Publicly owned buildings currently out of use represented on base maps at adequate scales provided by Spanish DG Cadastre and Xunta de Galicia (Galician Autonomous Government), or produced by accordance between DPC and the mentioned DG Cadastre.

From 7th june 2007, the second version of our web mapping site will be officially launched, becoming also a node of Spanish Spatial Data Infrastructure (IDEE).

4. Cartographic Educational Centers

4.1. Superior Technical Schools of Engineering in Topographic, Geodesy and Cartography

4.1. Superior Tecnical Scools of Enginnering in Topographic, Geodesy and Cartography

Crta. de Valencia, km 7,5
28031 Madrid-Spain
www.topografia.upm.es
www.upm.es

INTRODUCTION: NEW INSTITUTIONAL CONTEXT IN HIGHER EDUCATION

The aspects dealt with in many conferences underline the need to update and upgrade our teaching and training programs. However, besides the technological changes, many other institutional issues are also taking place now, at least within the European framework. The main issue in this respect is the Bologna Process which main purpose is the creation of the European Higher Education Area (EHEA).

The Bologna Process

Though there has been a first meeting in Sorbonne the year before, it was in 1999 in Bologna where 29 European ministers in charge of higher education met to lay the basis for establishing a European Higher Education Area by 2010. The Bologna Declaration [4], as signed by different ministers, is aimed to reform the structures of European higher education systems in a convergent way. To attain the Declaration's objectives they proposed the following measures:

- Adopt a system of easily readable and comparable degrees.
- Adopt a system with two main cycles (undergraduate/graduate).
- Establish a system of credits (such as ECTS).
- Promote mobility by overcoming obstacles.
- Promote European co-operation in quality assurance.
- Promote European dimensions in higher education.

The Bologna process aims at creating convergence of the European higher education systems in order to enhance the employability and mobility of citizens and to increase the international competitiveness of European higher education. To follow up the Bologna Process and assess the evolution of the different actions taken, regular meetings have been held in Prague (2001), Berlin (2003) and Bergen (2005) where Ministers responsible for higher education in 45 European countries were met. In all this meetings, comments, suggestions and new proposals came up with regard to the different objectives of the Bologna Declaration. As an example, in Berlin the Ministers also considered necessary to go beyond the present focus on two main cycles of higher education to include the doctoral level as the third cycle in the Bologna Process and to promote closer links between the European Higher Education Area (EHEA) and the European Research Area (ERA). Doctoral studies are the synergy between EHEA and ERA.

Socrates is the European programme for education and training [5]. Its aim is to promote the European dimension and to improve the quality of education by encouraging cooperation between the participating countries and thus provide a response to the major challenges of this new century: to promote lifelong learning, encourage access to education for everybody, and help people acquire recognized qualifications and skills. Amongst the different Socrates actions, Erasmus [6] is the European Community programme in the field of higher education. It was established in 1987 and currently 2199 higher education institutions in 31 countries are participating in ERASMUS. Since then, 1.2 million students have benefited of an ERASMUS study period abroad. It seeks to enhance the quality and reinforce the European dimension of higher education by encouraging transnational cooperation between universities, boosting European mobility and improving the transparency and full academic recognition of studies and qualifications throughout the Union. The main Erasmus activities are mention here [6]

- Student and teacher exchanges.
- Joint development of study programmes (Curriculum Development).
- International intensive programmes.
- Thematic networks between departments and faculties across Europe.
- Language courses (EILC).
- European credit transfer system (ECTS).

The students' mobility has experimented a significant increase from around 3.000 students in 1987 to over 135.000 students in the regular course 2003-04. The figure 1 gives and overview of the evolution of these numbers and about the different participation of the member countries.

To have an idea about Erasmus activities, just to mention that during the academic year 2003/2004 the Commission financed 63 Curriculum Development projects, 202 Intensive programmes and 37 Thematic Networks between departments and faculties across Europe. One of these is Thematic Networks, EEGECS, is related

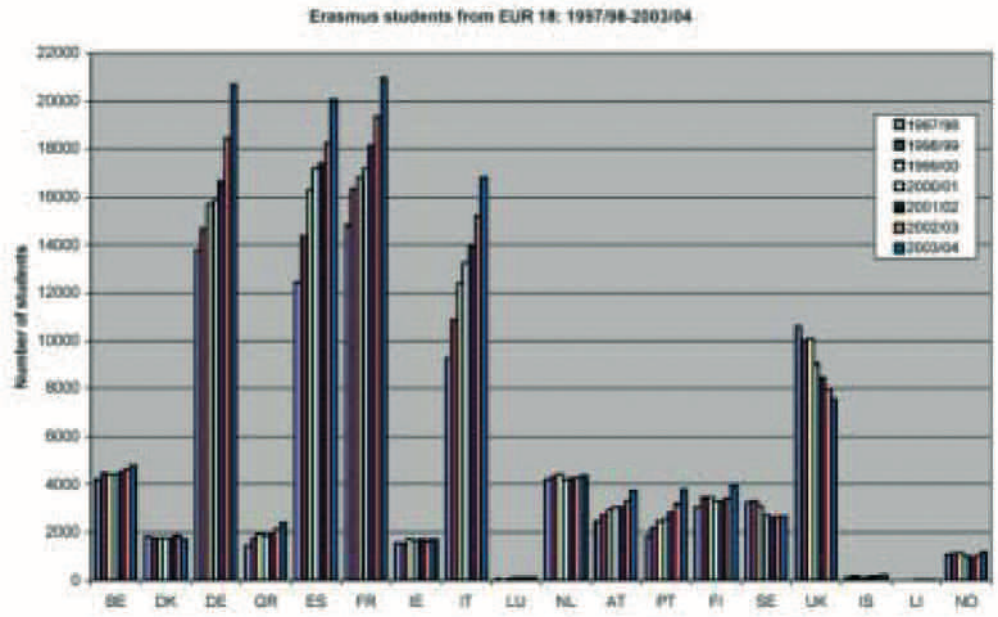


Figure 1. Erasmus Students in a recent 7 years period [7].

to our professional field and stand for «European Education in Geodetic Engineering, Cartography and Surveying». It started its project in 2002 and has a partnership of 100 institutions from 28 different European countries. Currently, it is structured in 6 working groups as described below:

- WG1: Undergraduate Education.
- WG2: Research.
- WG3: Continuous Education, E-Learning and the European Dimension of Studies.
- WG4: Enterprises-Private Sector.
- WG5: Mobility, Languages, Culture, Citizenship, Social Cohesion.
- WG6: Quality Assurance.

Some reports about their progress and findings can be download from its web site [8]:

THE NEW SPANISH PROPOSAL OF ENGINEER IN GEOMATICS AND SURVEYING

In Spain, following the Bologna process several actions have been undertaken. Firstly, in the year 2000 the Confederation of Rectors of Spanish universities, in their General Assembly, underlined the need to integrate our higher education system in the EHEA. In 2001 some pilot projects were conducted. Furthermore, a new Spanish law related to universities, the so called LOU (Dec/2001) contributed to officially support the convergence principles of the Bologna Directiva. Nowadays, several official decrees such as the related to the implementation of the Diploma Supplement and ECTS-compatible credit system, have already been published.

The National Agency for Evaluation of Quality and Accreditation (ANECA), of the Spanish Administration, financed a project aimed to establish the degree of Engineer in Geomatics and Surveying following the Bologna Directive. The working group was integrated by 12 related Spanish universities (see figure 3) and 2 professional associations (Surveying engineers and Geodesy and Cartography engineers). Their first task carried out was to make a comparative analysis of the situation amongst European universities in relation to some aspects: the duration of the studies (see figure 2), the degree of implementation of the Diploma Supplement, the establishment of the ECTS system and the two cycle (undergraduate/graduate) system, the degree of specialization and the students training in companies amongst others.

The working group that developed the proposal was formed by members of the following Universities:

- Universidad de Alcalá de Henares.
- Universitat Politècnica de Catalunya.
- Universidad de Extremadura.
- Universidad de Jaén.
- Universidad de Las Palmas de Gran Canaria.
- Universidad de León.
- Universidad Politécnica de Madrid.
- Universidad de Oviedo.
- Universidad Politécnica del País Vasco.
- Universidad de Salamanca.
- Universidad de Santiago de Compostela.

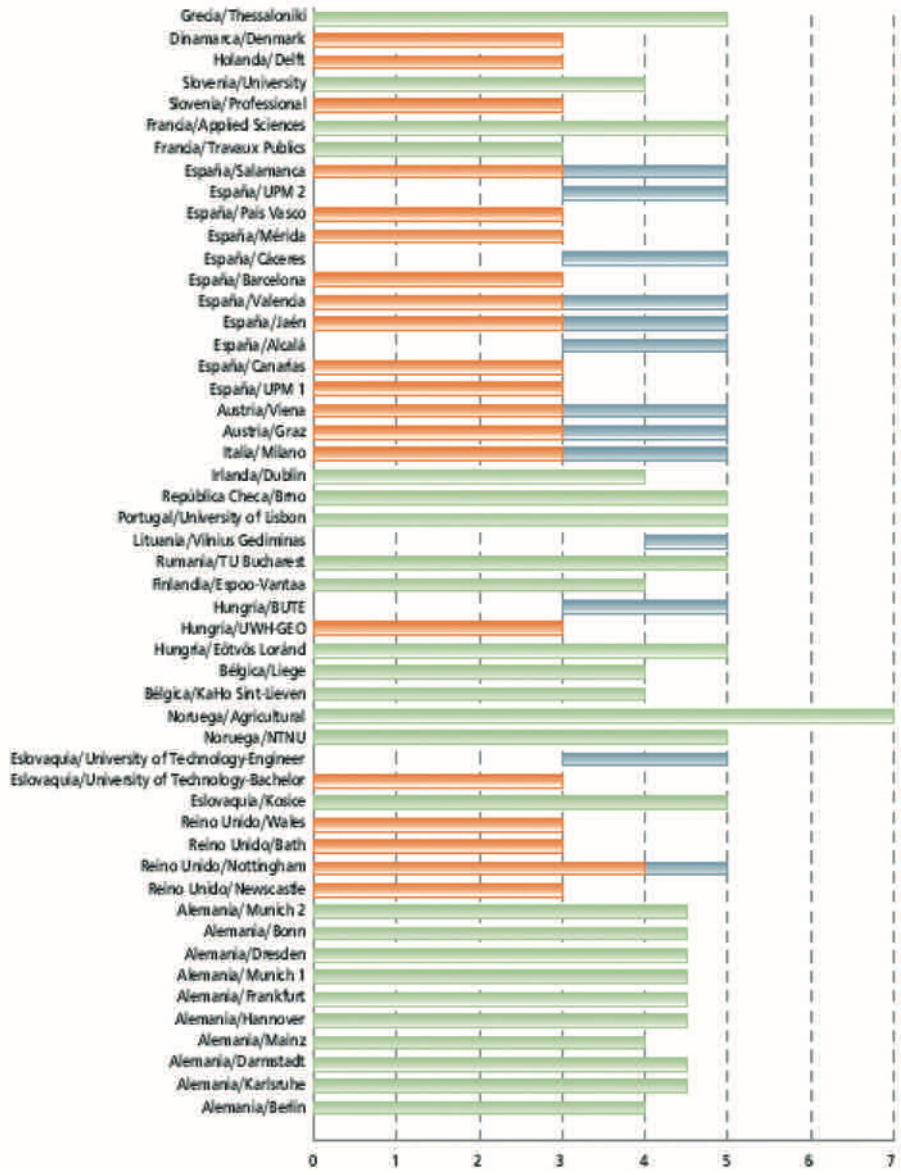


Figure 2. Differences in duration in distinct European University programmes [8].

— Colegio Oficial de Ingenieros Técnicos en Topografía.
— Asociación de Ingenieros en Geodesia y Cartografía.

The coordination was conducted by the Escuela Técnica Superior de Ingeniería Geodésica, Cartográfica y Topográfica of the Technical University of Valencia (UPV). The next figure shows the spatial distribution of these faculties.

Besides the differences in length of the distinct study programmes, were also found differences in structure and contents amongst the European titles or degrees as is portrayed in figure 4. These findings were also considered in the structure of the final proposal.

Figure 3. Spatial Distribution of Surveying Engineer (Bsc) and Geodesy and Cartography (Msc) Faculties [8].

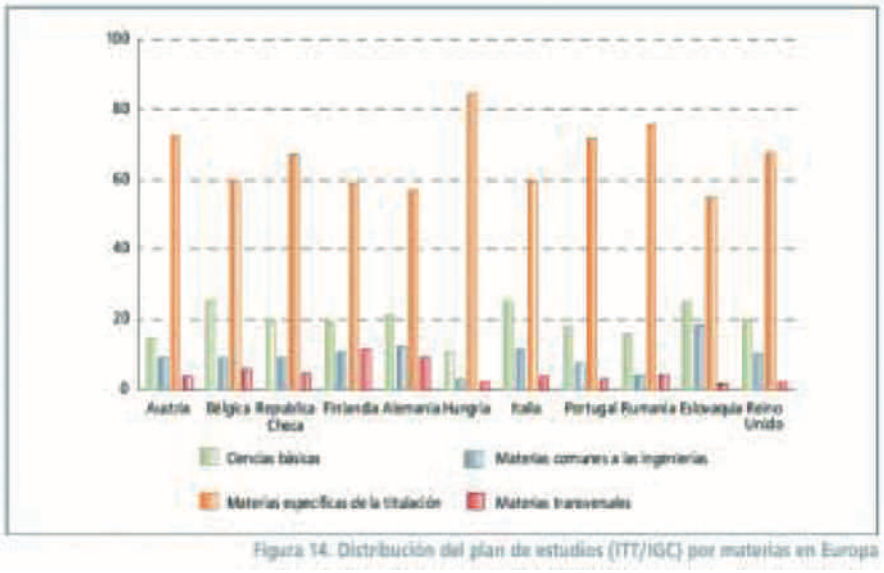


Figure 4. Differences in contents and structure amongst distinct European University programmes [8].

For the above mention analysis were considered many of the findings and reports collected and published by the EEGSCS thematic network[8]. A short summary of the work done by its WG1 is included here:

- There are only 2 countries (Lithuania and Denmark) where their universities have implemented 3 main parameters related to the convergence in the EHEA (ECTS, Diploma Supplement and 2 Cycle system).
- Other countries like the Netherlands, Austria, Hungary, Norway and Slovak Republic are rather advance in the process, though their universities still need some extra effort for a better integration.
- The rest of the countries and universities still need an important effort to achieve the comparability and compatibility of their degrees. Though there are some exceptions such as the Polytechnic University of Valencia (Spain) and The Nottingham Trent University (UK) what are in a more advanced phase.

Two main models were identified at the initial stage: a continental model and a British model. The continental model offers two main options: one of basically 5 years plus a final project, and a short one of 3 years plus a final project. They both run parallel and the access for the students, from one to the other, is restricted what is a clear disadvantage. The British model offers a 3 or 4 years degree (Bachelor) and 1 or 2 years second cycle (Master). The students can follow one after the other, what is a clear advantage, and satisfy, at the same time, the cyclic criteria of Bologna process.

Apart from the model o structural differences, the big discrepancies in duration of the studies in Surveying Engineer, from 3 to 7 years, is a quite remarkable detail (see figure 2). Other distinct approaches were identified in relation to practical training of the students in companies, number of specializations, estimation of the number of hours per credit, the degree of adaptation to Bologna criteria, etc.

After this first comparative analysis carry out about the related universities in Europe and Spain, some labour market study was conducted in order to evaluate the ease of integration of our students. Besides that, the opinion of different social agents (employers, professional surveyors and university teachers) was collected through questioners. This served to identify the existing weaknesses and the desire knowledge and skills of the future surveying engineers and to design different professional profiles. In order to define the structure of the new degree some reference models were also considered:

- Technical University of Munich (Engineer in Geodesy and Geoinformation).
- Greek University of Tesalónica.
- The ETH University of Zurich (Engineer in Geomatics).

The first two belong to the European High Education Area but not the third one that was explicitly taken as another outside EHEA reference. As a result of all the works briefly described so far, it was submitted the new proposal to the National Agency for Evaluation of Quality and Accreditation (ANECA), of the Spanish Administration, for its final approval. The main characteristics of this degree are the next:

- Name: Engineer in Geomatics and Surveying.
- Model: 2 cycles (undergraduate and graduate).
- Degree or first cycle (Bachelor): 4 years (240 ECTS).
  - 70% Credits (Main core).
  - 30% Credits (Free for each University).
- Final career Project obligatory.
- Optional: Master (60/120 créditos ECTS).

As long as the ECTS is concerned, it was estimated a value between 25-30 hours/per credit. So, as each year will have 60 credits, this will mean an amount of about 1500-1800 working hours load for the students. The main core (70% or 168 ECTS) will consist of different subjects grouped in four thematic blocks as shown in the table below.

TABLE 1

Main structure and contents of the Degree in «Engineer in Geomatics and Surveying»

	Group of Subjects	Percentage	ECTS
Block 1	Basic Sciences	20	34
Block 2	Common subjects for Engineers	16	27
Block 3	Specific Subjects for the Degree	60	100
Block 4	Transversal Subjects	4	7
	Total	100	168

The block 1 includes subjects like Mathematics, Physics and Computer Sciences. Block 2 consists in subjects who are common in most of the engineering degrees: civil engineering, computer graphics, environmental engineering, and geomorphology and projects management. The block 3 will be integrated for all the subjects related to the main professional knowledge and skills: surveying, geodesy, geophysics, photogrammetry, remote sensing, cartography, GIS, etc. Finally, the block 4 will be devoted to economy, legal aspects and management.

The remaining 30% of the credits will be freely designed by each university depending on their geographical situation, socio-economical environment or their specific interests o, simply, to have some degree of specialization. Though, for this last purpose, different Master courses will be designed and implemented.

Besides this brief analysis of the European and Spanish academic situation, many other significant efforts are being made worldwide in relation to curriculum development. In this respect the "Strawman Report" [9] and the works done by the University Consortium for Geographic Information Science –UCGIS- [10] might be quite relevant in relation to model curricula development.

REFERENCES

[1] Sistema Información Territorial de Navarra. SINTA website http://sitna.cfnavarra.es/.
[2] IGN-E (2005) «Strategic Plan 2004-2007 and Main Projects Status». Publication of the Directorate General of the NationalGeographic Institute. (IGN-E).
[3] IDEE Geo-Portal (NSDI of Spain): http://www.idee.es/.
[4] The Bologna Declaration (1999). Document download from http://www.bologna-bergen2005.no/.
[5] Socrates:Europe Education and Training Programme http://europa.eu.int/comm/education/index_en.html.
[6] SOCRATES-ERASMUS Programme: http://europa.eu.int/comm/education/programmes/socrates/erasmus/erasmus_en.html.
[7] ERASMUS-STATISTICS: http://europa.eu.int/comm/education/programmes/socrates/erasmus/statisti/stat15.pdf.
[8] EEGECS Thematic Network http://www.top.upv.es/eegecs/main.asp.
[9] The Strawman Report (2003). Development of Model Curricula for Geographic Information Science & Technology. University Consortium for Geographic Information Science (UCGIS).
[10] UCGIS Website: http://www.ucgis.org/.

[11] INSPIRE- Infrastructure for Spatial information in Europe (2004). Directive of the European Parliament and of the Council. http://www.ec-gis.org/inspire/.
[12] OGC - Open GeoSpatial Consortium website http://www.opengeospatial.org/.
[13] IDEC- Spatial Data Infrastructures of Catalonia website http://www.geoportal-idec.net/.

EDUCATION ACTIVITIES

The ETSI en Topografía, Geodesia y Cartografía currently has implemented the teaching structures aiming to obtain the degree of Surveying Engineer (Bsc) and Engineer in Geodesy and Cartography (Msc). To give and idea of the formal teaching activities is presented below in table form some statistics related to the number of students enrolled in each degree.

TABLE 1
Students of the ETSI en Topografía, Geodesia y Cartografía

a) Surveying Engineers			
Year	Male	Female	Total
2003-2004	507	214	721
2004-2005	485	182	637
2005-2006	425	196	621
2006-2007	402	192	594

b) Engineers in Geodesy and Cartography			
Year	Male	Female	Total
2003-2004	52	40	92
2004-2005	52	36	88
2005-2006	40	41	81
2006-2007	45	37	82

The overall trend of the total number of students, including sex specification, can be better perceived from the graphics derived from the above statistics. The next two figures show the evolution of the number of students separated by degree.

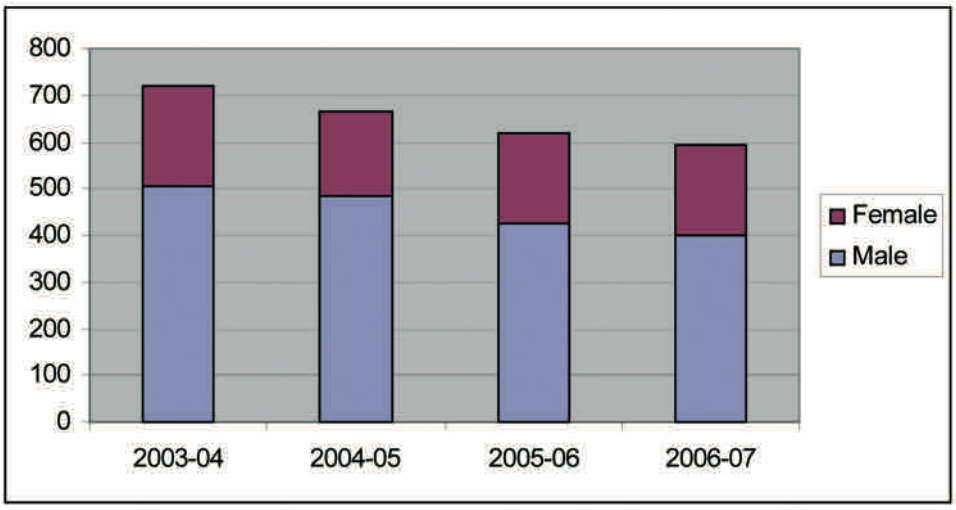


Figure 1. Number of Students of the Surveying Engineer Degree(Bsc).

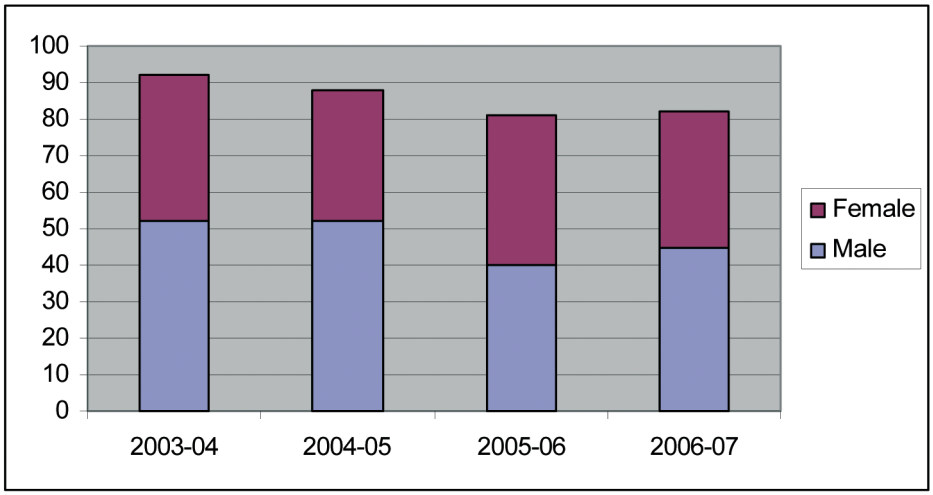


Figure 2. Number of Students of the Geodesy and Cartography Engineer (Msc).

Besides, the first and second cicle, since the 2003-2004 year has been running a PhdProgramme. Some details can be seen in the next figure.

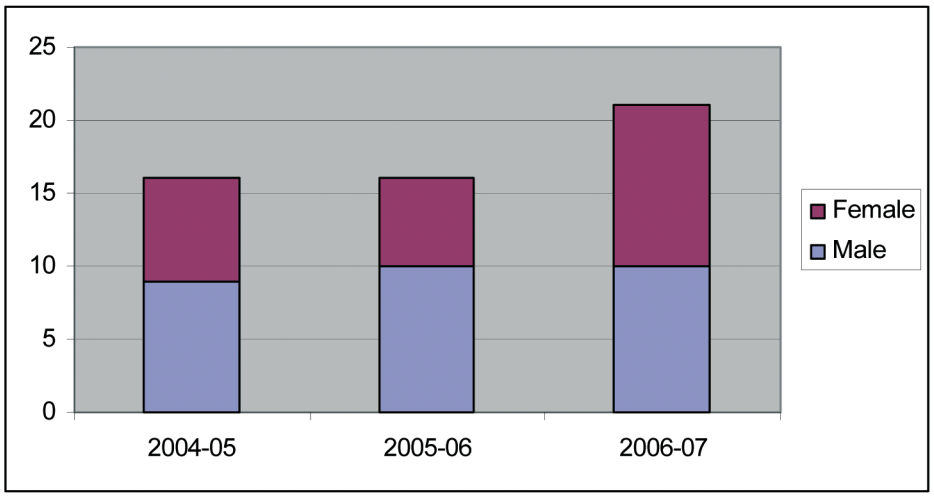


Figure 3. Number of Phd Students.

The total number of students who has completed their studies and got their degree arepresented below in tabular and graphical form.

TABLE 2

Students who has finished their studies in the last 3 years

	Surveying (Bsc)	Geodesy and Cartography (Msc)
2003-2004	77	11
2004-2005	64	12
2005-2006	83	8

The same data in graphical form is depicted in the next figure.

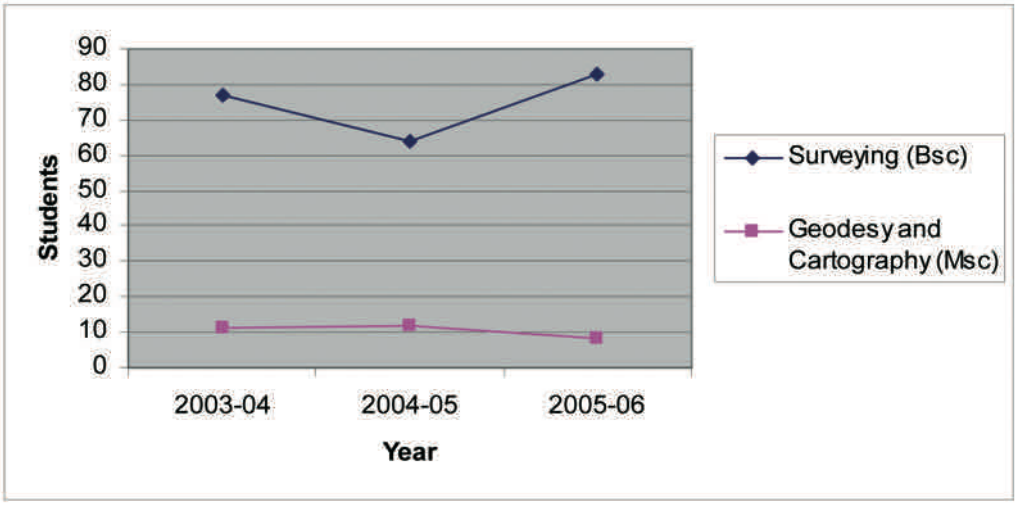


Figure 4: Students who has finished their studies in the last 3 years.

Apart from the education activities aimed to get the official diplomas, some other teaching activities are conducted and briefly described in this report. A first group of complementary education activities is devoted to the training of unemployed man/woman. The Technical University of Madrid (UPM) is the most active amongst the 14 Universities of Madrid Regional Government. The ETSI en Topografia, Geodesia y Topografía gives between 10 and 15 courses per year of this nature with 20 students per class. All these extra training activities aim to reduce the unemployment rate of Madrid working area. The subject matters dealt with in these courses are related to Photogrammetry, Digital Mapping, Remote Sensing, GPS, Digital Terrain Modeling, Geoinformation Systems, Archaeology, etc. All these courses are financially support by the Instituto Nacional de Empleo –INEM (National Institute for Unemployment).

Another activities that can be mention in this block are continuous learning task o courses organized for postgraduates. Quite often, these activities are promoted by professional associations. Some tailor made courses for private companies can also be prepared on demand. Finally, some other activities are supported by public administration like the courses about the promotion of Spatial Data Infrastructures (SDIs).

PROFESSIONAL AND RESEARCH ACTIVITIES

Research Lines

Geographic information capture.
Geographic information processing.
Geographic information visualization.

PROFESSIONAL ACTIVITIES: PROJECTS AND COURSES

Projects. Engaged companies shown in green

Projects for the National Geographic Institute (IGN) 2005:

- 1:500,000: Design of a methodology optimized for the revision and update of cartography. Application of this methodology to the revision of the Map of Spain on the 1:500.000 scales, included in the National Atlas of Spain.
- Cartociudad I: Research and development of the appropriate technology and methodology for GI harmonization of the 1:25.000 Numerical Cartographic Base of the Computerized Urban Cadastral Cartography and the Electoral Roll Street Directory.
- IaTEL: Agricultural environmental indicators in Spain using low tomedium resolution EO satellite images. Methodology.
- Líneas Límite I: Development of the methodology for optimization ofthe IGN Boundary Line Database (Bentley Systems Ibérica, S. A.).
- Metadatos I: Further development of technology and methodology for the Spanish SDI (IDEE) metadata capture and the IGN node of geographic data and service distribution and mediation.
- Nomenclátor: Research and development of the appropriate technologyand methodology for the creation of the Distributed National Gazetteer (Iver Tecnologías de la información, S. A.).
- Siane: Research and development of the most suitable technology and methodology for the generation of Thematic Cartography by using data and objects collected from the information system of the National Atlas of Spain.

Projects for the IGN 2006

- Cartociudad II: Research, development and application of a methodology for quality control of the Cartociudad project (Sitco Consulting, S. L.).
- Líneas Límite II: Research and development of the most appropriateGIS for the management and update of the Boundary Line NationalRegister.

Anticipated Projects with IGN for 2007

- Metadatos II.
- Cartociudad III (Stereocarto).
- Training (SDI e-Learning and Thematic Cartography e-Learning).
- Website for the National Atlas of Spain.
- 7 Photogrammetry / Remote Sensing Projects.

Other Projects

- IDEDES: Study of the SDIs in Latin America and the Caribbean region. Funding: CYTED.
- DIGMAP: Development of a Historical Digital Map Library. Funding: eContentPlus.
- e-Learning gvSIG: Creation of a platform and development of contents for teaching of the gvSIG Programme. Funding: Generalitat Valenciana.
- e-Learning GIS: Development of contents for an IGN-endorsed GIS course. (Ibermática S. A.) Funding: IGN.
- Predecan: Supporting disaster prevention in the Andean Community (Infraestructura y Ecología S. L.) Funding: European Commission.
- Towntology: Ontology for Civil Engineering related to urban building projects. Funding: Official Announcement COST.
- Tiermes (European Communication LIFE): Salvage and restoration of the Tiermes archaeological site and establishment of expediting plans for the adjoining region.
- Newsletter IDEs Creation of an SDI Newsletter targeted at Latin America and the Caribbean region.

Courses

- Postgraduate Courses imparted in 2006-2007, funded by the IGN and the Spanish Agency of International Cooperation (AECI):
  - GPS (150 hours).
  - SDIs (150 hours).
  - Remote Sensing (150 hours).
- Courses funded by the Ministerio de Fomento 2005 (Ministry of Public Works):
  - CatMDEdit.
  - IDE-E (Atos Origin S.A Española, Tragsatec).
- Courses funded by the Ministerio de Fomento 2006:
  - Geoservices OGC (Atos Origin S. A. Española).
- Other Courses:
  - Course on SDIs –University of Catamarca (Argentina).
  - Course on SDIs-University of Granada (Spain).
  - Course on Digital Geoinformation UPM (Spain).
  - Course on SDIs- Universidad del Litora, (Argentina).

DISSEMINATION, PROMOTION AND OTHER SUPPORTING ACTIVITIES

The UPM´s members have actively participated in many conferences, seminars and workshops presenting papers and posters. At the same time, some events have also been held at the Technical University of Madrid (UPM) and we could mention here some of them as those organized at the ETSI en Topografía Geodesia y Cartografía (ETSITGC). At the international level we could mention the Joint ICA Commissions Seminar entitled: «Internet-Based Cartographic Teaching and Learning: Atlases, Map Use, and Visual Analytics» that was organized by the Research Mercator Group (ETSITGC) in close cooperation with the ICA Commissions´ chairmen and the Spanish Society of Cartography, Photogrammetry and Remote Sensing (http://www.secft.org/). In this event

participated more than 90 people from 25 countries and it was arranged as a part of the ICC2005 Conference held in A Coruña in July 2005.

Another important event organized by the Department of Engineering Surveying and Cartography, under the coordination of the Research Mercator Group, was the annual meeting about the Spatial Data Infraestructures (http://www.idee.upm.es/jidee05/index.php). This conference gathered together more than 200 professionals, university teachers and students coming from all over the Spain. The status of development of SDI implementations were widely discussed and analyzed.

In order to facilitate the integration of our students in the market some activities have been arranged such as the meeting with the main civil engineering and building companies. In relation with the public administration a significant agreement was signed with the National Geographic Institute (IGN) as the building stone of the Latingeo Laboratory (http://www.latingeo.net/). In this laboratory multiple projects are carried out as described above in point 2 of this report.

To improve the relations between all members of the Faculty some regular teachers-students meetings to broadcast the activities are organized by the Department of Engineering Surveying and Cartography with the name of EPADA (Encuentros Profesores-Alumnos para la Difusión de Actividades). In these meetings some small conferences are presented and afterwards are followed by informal debates that encourage the participation of all the members. Other activities, like Astronomy and cinema seminars, are also organized to enhance the participations of all members of the community.

In relation to the society as a whole, and not only the professional market, there have been some participation in different events such as the Madrid´s Science week and the book fair The purpose of these actions is to increase and improve the knowledge of the citizens about our profession. The photo below shows some moment of the event with interested visitors.

Because a double decentralization process: from the central government to the regional government and from the public sector to the private sector, there has been a significant increase of faculties in Spain. As long as Surveying Engineering is concerned, we have move from 3 to 11 faculties in the last 2 decades. This also produced un unbalanced situation between offer and demand, and for this reason is becoming more and more difficult to get students in all type faculties and specialities. For this reason, some promotion activities of our studies and career have been undertaken like different promotional videos and the visit of about 150 secondary schools. Besides that, our faculty has also received the visit of students from different schools. By doing so the potential students can get a direct contact with our profession and the type of activities we carry out in our daily life.

Finally, just to mention here that Surveying engineers celebrate its annual party the 26th of April every year and this day is known as «San Isidoro». In this day, multiple sport and cultural activities are celebrated and enjoyed by everybody.

5. Other Cartographical Centers

5. Other Cartographical Centers

GRAFINTA, S. A.
Avda. de Filipinas, 46
28003 madrid (Spain)
Phone: +34 91 553 72 07

SOCIEDADE PARA EU DESENVOLVEMENTO COMARCAL DE GALICIA
A Barcia, Crtra. Santiago-Noia, km. 3
15896 Santiago de Compostela- A Coruña (Spain)
Phone: +34 981 54 58 11
Fax: +34 981 52 25 64

INSTITUT DE GEOMÀTICA
PARC MEDITERRANI DE LA TECNOLOGIA
Avda. del Canal Olímpic, s/n
E-08860 Castelldefels-Barcelona (Spain)
Phone.: +34 93 556 92 80
Fax: +34 93 556 92 92

INSTITUTO NACIONAL
DE TECNICA AEROESPACIAL
(INTA)
General information
Phone: +34 91 520 12 00
Fax: +34 91 675 52 63

INDRA SISTEMAS, S. A.
Avda. Bruselas, 35
28108 Alcobendas – Madrid (Spain)
Phone: +34 91 480 50 00
Fax: +34 91 480 50 57

AEROPUERTOS ESPAÑOLES Y NAVEGACIÓN AÉREA
AENA-General information
www.aena.es

SENER
Severo Ochoa, 4
Parque Tecnológico de Madrid
28760 tres cantos – Madrid (Spain)
Phone: +34 918 07 70 00
Fax: +34 918 07 72 01

GMV AEROSPACE AND DEFENCE S. A.
Isaac Newton 11 P.T.M.
28760 Tres Cantos – Madrid (Spain)
Phone: +34 91 807 21 00
Fax: +34 91 807 21 99

DEPARTAMENTO DE GEOGRAFÍA
Y ORDENACIÓN DEL TERRITORIO
FACULTAD DE FILOSOFÍA LETRAS
Universidad de Zaragoza
C/ Pedro Cerbuna 12,
50.009 Zaragoza (Spain)
Phone: +34 976.76.10.00 ext. 3909
Fax: +34 976.76.15.06

PRODUCCIONES GRÁFICAS PARA INSITUCIONES PÚBLICAS, S. L.
c/ pastor díaz, 1
15006 a coruña (Spain)
Phone: +34 981 17 57 77
Fax: +34 98117 57 78

GEODÓS CARTOGRAFÍA, S. L.
C/ Velázquez, 46 - 1º - 16
28001 Madrid (Spain)
Phone/Fax: + 34 91 431.33.76

GEOSTEL , S. A.
C/ Diputació, 250
08007 Barcelona (Spain)
Phone: +34 93 412 00 30
Fax: +34 93 412 75 50

GRAFCAN–CARTOGRAFIA DE CANARIAS S.A.
C/ Panamá, 34. Naves 8 y 9, Polígono Costa Sur
Santa Cruz de Tenerife (Spain)
Phone: +34 922 23 78 61
Fax: +34 922 20 49 99

GEOGLOBAL.CAD, S. L.
C/ Xifré, 115 (local)
08026 Barcelona (Spain)
Phone/Fax: + 34 93 436 54 02

SMR SERVICES RESEARCH & MAPPING CONSULTING
C/cariátides, 49
28232 Las Rozas (Madrid) (Spain)
Phone: +34 669686565

DISEÑO GRÁFICO AM2000
Cicerón, 11
28020 Madrid (Spain)
Phone: +34 91 5350581
Fax: +34 91 5530061

MEMBERS OF THE BOARD
SPANISH SOCIETY FOR CARTOGRAPHY, PHOTOGRAMMETRY AND REMOTE SENSING

PRESIDENT

D. Ramón Lorenzo Martínez

VICE-PRESIDENT FOR CARTOGRAPHY

D. Fernado Aranaz del Río

VICE-PRESIDENT FOR PHOTOGRAMMETRY AND REMOTE SENSING

D. Jaume Miranda i Canals

SECRETARY GENERAL

D.ª M.ª Pilar Sánchez-Ortiz Rodríguez

VICE-SECRETARY FOR CARTOGRAPHY

D.ª M.ª Dolores Abad Moros

VICE-SECRETARY FOR PHOTOGRAMMETRY AND REMOTE SENSING

D. Adolfo Dalda Mourón

TREASURER

D. Agustín Cabria Ramos

OTHER MEMBERS OF THE BOARD

D. Jaume Massó Cartagena
D. José María Fernández López
D.ª Águeda Saúco Escudero
D. Miguel Ángel Bernabé Poveda
D.ª Concepción Romera Sáez
D. Rufino Pérez Gómez