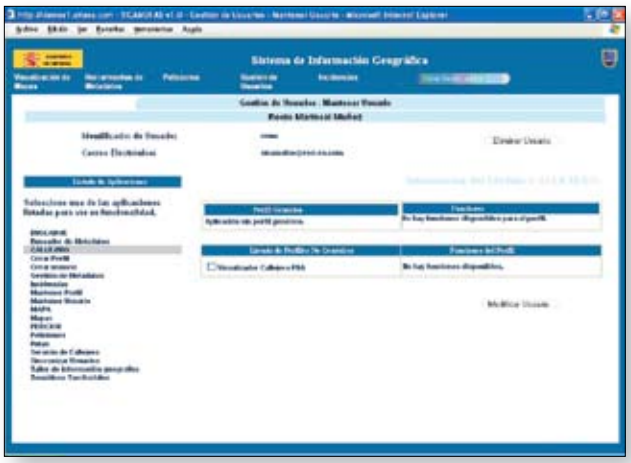
Implementation of a Cartographic, Meteorological, and Oceanographic Information System for the Spanish Armed Forces



Prologue

Between 1999 and 2001, the Spanish Ministry of Defense (MOD) conceived the Director Plan CIS for the development and adaptation of the Spanish Armed Forces to new technologies, establishing as its objective the normalization, modernization, and professionalization of the resources and systems employed. The plan seeks the optimization of every resource involved in obtaining those systems. This effort of optimization of resources pursues the following goals:

- Promote the usage of COTS within the information systems of MOD. The usage of the current standards and emerging technologies permits concentration of effort in the specific functionalities of the applications instead of the developments of basic spatial capabilities already provided by GIS.
- Reduce the total life cycle cost. The usage of COTS contributes to significantly decrease the time spent in the development of new applications.
- Strengthen scalability and portability. The usage of COTS based on open standards architectures for the applications will allow them to run on heterogeneous platforms.
- Ensure interoperability. Through using standard products, the level of internal and external (NATO countries) interoperability will increase.
- Increase the efficiency of end users. Employing similar man-machine interfaces for all the applications simplifies deployment and significantly reduces training costs.
- Optimize administrative issues. The usage of standard products simplifies the technical and administrative/financial management of the systems and applications. Consequently, it works in favor of saving money in acquisitions and maintenance too.
- Preserve security effectively. The fulfillment of security requirements in the treatment of information may be simplified thanks to its unique management.

The execution phase of the plan began in 2002 through the fulfillment of several concrete actions to meet the requirements of MOD. For this purpose, the General CIS Office was created. Within the framework of the MOD objective to obtain 37 information systems, the Cartographic, Meteorological, and Oceanographic Information System for the Spanish Armed Forces (SICAMOFAS) was acquired.

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In this context, the General CIS Office launched late in 2003 a formal process to choose a GIS vendor as a standard for implementing the architecture objective for the Digital Geographic Information System of Defense. ESRI technologies were submitted for the benchmark testing.

The benchmark lasted five months and involved completing commercial and technical questionnaires; presentations; demos; visits to current customer references with enterprise GIS; and finally, the benchmark itself, which was required to pass demanding testing related to interoperability, raster and vector processing, creation of a continuous cartographic database, 2D and 3D analysis, development of GIS applications, and digital/analogical dissemination of information.

In the end, the General CIS Office chose ESRI technology for the mandatory GIS components for the Digital Geographic Information System of Defense.

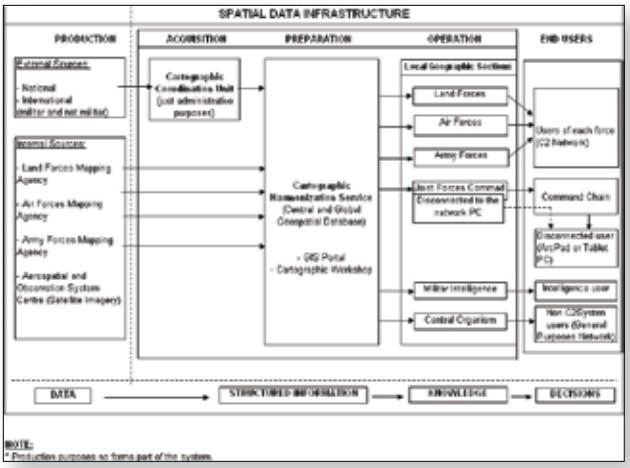
Scope of the System

As a whole, the system will assume the functions of acquisition, preparation, and exploitation of digital geographic information. The functions of cartography acquisition (carried out by external sources) will be a task of the Cartographic Coordination Unit; the functions of preparation will be the responsibility of the Cartographic Harmonization Service (SAIG); and finally, the tasks of exploitation will be the responsibility of Geographic Support Devices (also known as Local Geographic Sections) in support of end users located in Land Forces, Air Force, Navy, and Joint Command headquarters; Intelligence Agency; and the Central Organization.

Objectives

- The system will be the only one for the whole MOD. Technical resources will be provided for the management of the tools.
- The Digital Geographic Information System of Defense must be a useful tool to support decision makers, so it must provide to every echelon the required information.
- The Digital GIS of Defense must meet the requirements related to definition, access, analysis, editing, integration, publication, and dissemination of spatial data for MOD systems, within command and control as well as general purpose environments.
- The digital geographic information will be structured in spatial databases according to a specific data model. This data may be general purpose as well as specific command and control data. The data management may be either distributed or centralized, depending on need.
- The Digital GIS of Defense must include facilities to distribute digital spatial data to any unit or dependence regardless of its location (national or deployed abroad).
- It must work within a telecommunications infrastructure network with enough bandwidth including the massive exchange of data through LAN and WAN. On one hand, there will be a command and control WAN that will be connected to the Spanish and NATO tactical environments. On the other, there will be an enterprise general purpose WAN with more than 35,000 workstations connected.
- The system will deliver Web services when necessary.
- The system will incorporate the tools for following up incidents as well as the necessary mechanisms to implement security policy.
- The system will guarantee timely acquisition or production of spatial resources according to STANAGs or ISO standards.
- The system will be open to guarantee interoperability between national and international (NATO) systems.
- The Digital GIS of Defense will allow the display of information stored in the spatial database according to rules established by Spanish defense mapping agencies, catalogs of conventional symbology, and STANAGs.

The architecture of the Digital GIS of Defense is formally called Digital GIS Target Architecture. It is organized in several connected nodes through a WAN to allow the flow of geographic and tabular information.



Description of the Project

SICAMOFAS provides information stored in a relational spatial database management system according to the data models established by Spanish defense and nondefense mapping agencies and NATO standard symbology such as APP6A (STANAG 2019) and other current geography STANAGs.

SICAMOFAS is composed of a customized data model, which is capable of including, in a global and integrated way, cartographic products coming from several data sources (military and civilian) and two applications, the GIS Portal Toolkit and the Cartographic Workshop.

Data Model

The sources of information vary from vector, raster, DEMs, CAD, etc. They have been stored in the relational database management system with ArcSDE at the node called Cartographic Harmonization Service. This is a huge repository of spatial information that feeds the geodatabases of every node within Local Geographic Sections: Joint Forces, Land Forces, Navy, Air Forces, Intelligence, and General Purpose nodes.

Cartographic Workshop

This component manages the spatial data available in the enterprise repository of information. It receives the raw data from the mapping agencies (NGA, Spanish Armed Forces, Civilian Mapping Agencies, etc.) in different data formats, such as CAD, raster, DEM, orthophotos, satellite imagery, gazetteer, placenames, catalogs, and others, to preprocess, structure, store, and maintain the information. ArcGIS Desktop is used as a thick client to carry out this critical mission. Some customized tools have been developed to store standard military products (Vector Map [VMAP0, VMAP1], Digital Nautical Chart, S-57, Digital Terrain Elevation Data [DTED0, DTED1, DTED2], Compressed ARC Digitized Raster Graphic [CADRG], and cartography of the Land Forces Mapping Agency at 1:50,000 and 1:250,000 scales) as well as civilian (street maps, DEMs, National Topographic Model 1:25,000, Corine LandCover, etc.).

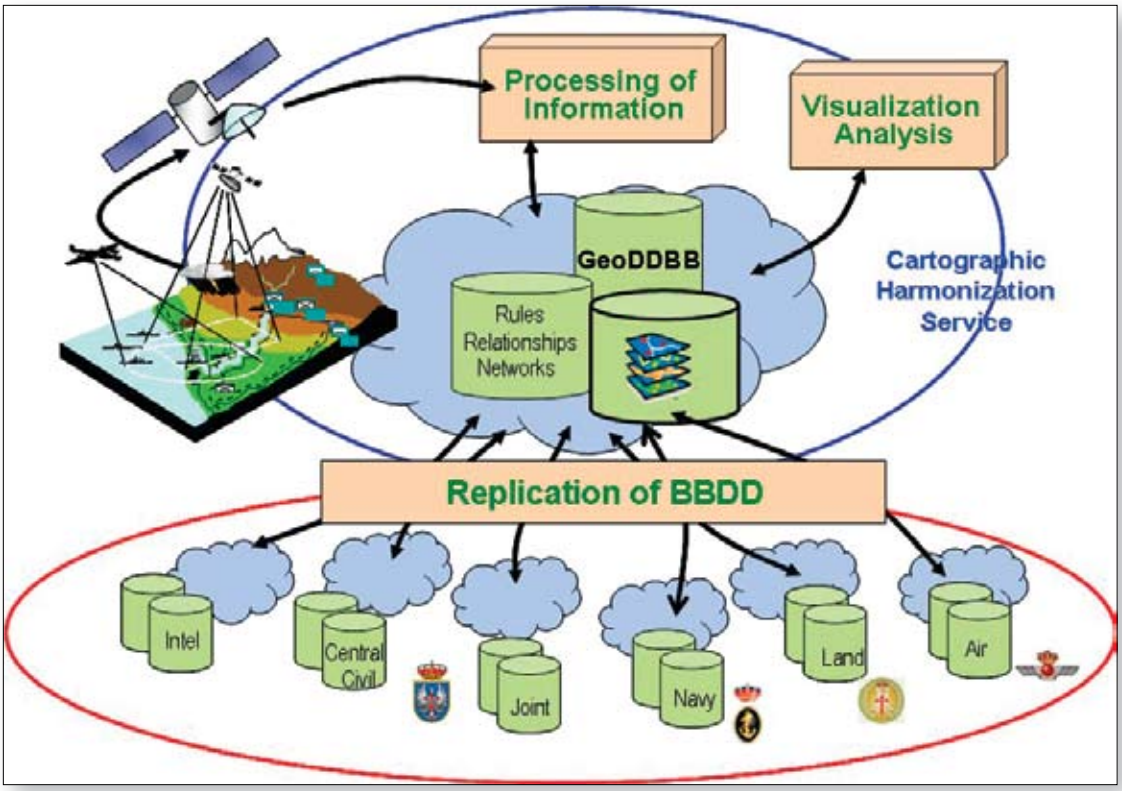
GIS Portal

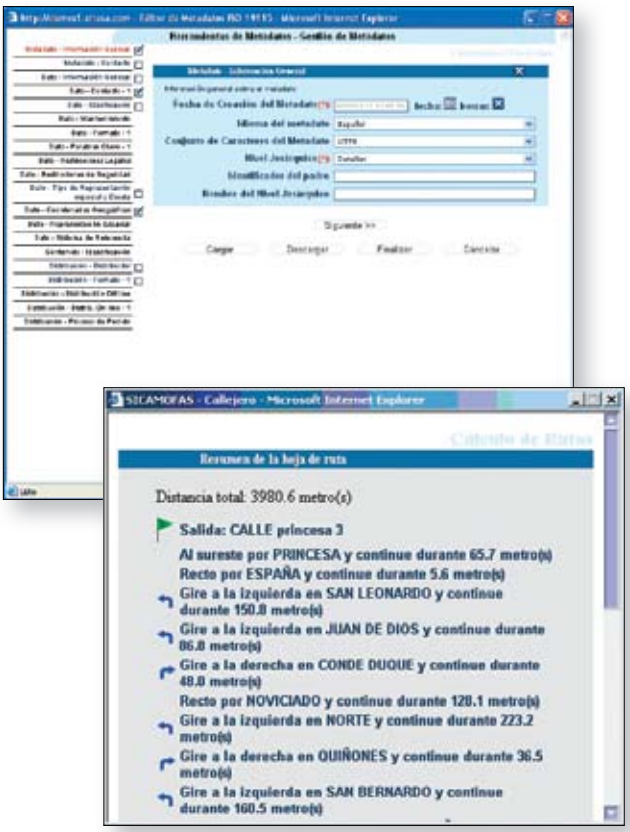
This Web facility contains several applications, as follows:

- Geographic visualization: This allows the visualization of all available cartography, possessing functionalities for pan, zoom, identify, selection, measure, search of elements, printing of maps, and creation of thematic maps. This application can locate and convert coordinates.
- Street maps: This permits searches in the available street maps of Spanish cities as well as routing calculation between two or more points (ArcGIS Network Analyst).
- Metadata manager: This permits the user to inventory the metadata through an editor and maintain it within a defined workflow. The metadata follows the Spanish standard NEM (Spanish Metadata Kernel), which is an ISO 19115 profile.
- Metadata searcher: This permits the user to search geographic information by means of metadata.
- Request manager: This permits the end user to request a particular cartography not available in the portal. The customized requests are conducted through access to standard forms to obtain the cartography in a supported digital format or paper (analog). This tool will make use of the ArcIMS Data Delivery extension so that it is easy to download data quickly in many standard spatial formats.
- Technical support facility: This application has been developed to allow the end user to inform system administrators of problems and anomalies detected in any piece of software or application of SICAMOFAS.
- Management of suggestions: This permits the end user to provide feedback to system administrators to enable the evolvement of the project.
- Management of end users: With this facility, system administrators can manage the access of every end user to not just the different applications of the portal but the functionalities enabled for them as well. This is done through the creation and management of profiles linked to each different group of users.

Thin Disconnected Client

A thin client was developed in the framework of the Cartographic Workshop as well as the GIS Portal.





Cartographic Workshop: The customized functionality allows insertion of pictures in a determined location.

GIS Portal: The developed functionalities are similar to those available for intranet browsers. They include

- Visualization of maps
- Street map
- Metadata searcher
- Management of cartography requests (includes cartography downloading)

The implementation of these GIS services for the Spanish defense community of users is providing clear benefits in data access and management, among other advantages. The deployment of the system and some new applications will continue to be developed during 2006 and 2007, as planned.