

Spatial Reference Systems in Argentina

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ABSTRACT

This is a follow up of a previous paper presented by the authors at the XXI FIG International Congress, Commission 5, in Brighton, UK in 1998. The paper was titled “Best practices in geopositioning technology transfer to developing countries” and dealt with issues related to the a) implementation of national spatial reference systems in the Americas and in Argentina in particular and b) impact of GPS technology on national mapping organisations responsible for the delivery of national spatial reference systems to the user community. The concluding statement was:

“The creation of a new order of things is difficult to manage, and solutions can seldom be imported from elsewhere to developing countries. Sustainable organisational and technological change should be based mostly on locally developed management and technical procedures and solutions. Close co-operation between academic departments, government agencies and private sector in the development of consensual procedures and locally-developed DGPS technology to access the reference systems may prove to be a sustainable approach to geopositioning technology transfer. The maintenance of open channels of communication between North and South American institutions with similar mandates can accelerate the process of change.”

Here we summarise the pertinent points of the previous paper and report on some recent progress in the “spatial reference system” debate in Argentina.

1. Introduction

Several billion dollars have been invested in the creation of digital geospatial data systems for a wide range of decision making, environmental monitoring, resource and land management applications, since the late 1960's. In the future, the focus is expected to shift towards the integration of these systems into National Geospatial Data Infrastructures, as governments at all levels in the United States of America and Canada cooperate with the private sector to more efficiently collect, integrate, manage and disseminate geospatial data using the emerging information highway (Nichols and McLaughlin, 1993).

National spatial reference systems form the fundamental layer of national geospatial data infrastructures and provide for common referencing of geographic information in a country. In the developed world, the implementation of national spatial reference systems is currently focused on “active control” technologies, as opposed to traditional monumented geodetic control. This trend is the product of advances in positioning and data communication technologies as well as new strategic directions for the agencies responsible for providing the national spatial reference system and related products and services to the user community.

2. Spatial referencing in Latin America

In Latin America, issues related to the development of National Geospatial Data Infrastructures have commenced only recently to receive attention in a co-ordinated fashion through initiatives such as the Interamerican Geospatial Data Network (IGDN, 1997). The IGDN was established by the United States Geological Survey and the U.S. Agency for International Development to strengthen the geographic information infrastructure of the region.

The recently completed South American control network, nicknamed SIRGAS for “Sistema de Referencia Geocentrico para America del Sur”, is the first step towards the implementation of a continent wide spatial reference system in support of the IGDN initiative (IBGE, 1997). SIRGAS defines for South America a uniform, geocentric frame linked to the International Earth Rotation Service (IERS) International Terrestrial Reference Frame ITRF.

Parallel to the spatial reference system developments at a continental level, the proliferation of mapping and cadastral development programs financed by international lending agencies has motivated the establishment of national spatial reference systems in a number of Latin American countries, including Argentina.

2.1 Spatial reference systems in Argentina

The Instituto Geografico Militar (IGM) is mandated by law (Ley de la Carta, 1941) to elaborate the Argentine official cartography and to establish the supporting

geodetic infrastructure. About 18,000 trigonometric points and 50,000 km of leveling lines materialise the horizontal (Campo Inchauspe 1969) and vertical datum in Argentina. An estimated 100% of the national territory is presently covered by cartography at 1:500,000, 60% at 1:100,000 and 25% at 1:50,000.

Since the seventies and the eighties, the operational capacity of the IGM has been decreasing steadily as the nation went from one financial crisis to the next. The dwindling authority of the IGM went unnoticed because hardly anything was happening in the geomatics sector in Argentina during these times. The landscape changed abruptly in the early nineties. Argentine geomatics received the biggest financial boost ever in the form of World Bank loans for the modernisation of provincial cadastral databases to support equitable property taxation (fiscal cadastre). The loans are administered and the fiscal cadastre projects are executed directly by provincial government through the Directorates of Cadastre. As a result, the elaboration of part of the cartography and the supporting geodetic infrastructure (new provincial geodetic control networks) was decentralised de facto and came under the authority of the Directorates of Cadastre in each province thus reducing the IGM to the role of a spectator of the process of cadastral modernisation.

The privatisation wave initiated by the Menem administration, also in the early nineties, succeeded in transferring large distribution and commercialisation networks of products and services to private hands thus intensifying the need of current land information. The Proyecto de Asistencia al Sector Minero Argentino (PASMA) is an illustrative example: It is also financed through international loans and aims at updating the national mining cadastre and securing title to mining property. The ultimate goal is to attract more foreign investment in the mining sector. During the first phase of PASMA, dense geodetic control networks were established in six Argentine provinces; a second phase will extend this network to the whole national territory (Gillone and Brunini, 1998).

The proliferation of fiscal and mining cadastre projects made the lack of geodetic leadership and coordination at the federal level painfully evident. Provincial project authorities – the Directorates of Cadastre- produced ambiguous tender documents with unclear geodetic specifications creating frequent conflicts between them and contractors. It was difficult for the contractors to implement ambiguous geodetic specifications and impossible for the project authorities to control the quality of the final product, i.e. the provincial geodetic network.

In 1993 the federal coordinator -Unidad Ejecutora Central (UEC)- of the provincial cadastral projects took the initiative of creating a new national spatial reference system in Argentina to provide a national framework for the emerging provincial networks established by the Directorates of Cadastre. The UEC entrusted the technical part of this task to the Universidad Nacional de La Plata and the IGM. The result of the initiative was the so-called POSiciones Geodesicas ARGENTINAS (POSGAR94) national spatial reference system featuring 127 monumented stations

separated by distances up to 200km. IGM issued a resolution in 1997 proclaiming the POSGAR94 spatial reference system the official successor to Campo Inchauspe 1969.

2.2 The spatial reference systems debate in Argentina

“.....We all recognise that some changes to our working environment are driven by technology; others stem from social, political and economic factors over which we have little or no control. But some changes, let us not forget, are brought about by ourselves, whether as ordinary citizens or surveyors. Never underestimate the power and influence of the individual – and that means each one of us! It is, in practice, individuals who change the world, even though it is not always in the way they intend.....”

Keynote Speech by P. Dale, President of FIG, Brighton 1998

In the midst of all these developments, researchers from the Universidad Nacional de La Plata and surveyors from the Professional Association of Argentine Surveyors took an interesting initiative. They organised a workshop titled „The future of geodetic control networks in South America and new concepts in cadastral surveys" and held in 1996 in La Plata, Argentina. The workshop was sponsored by the Commission 5 of the FIG, the Federal Council of Cadastre and the Instituto Geografico Militar. Among the participants were cadastral managers, leaders from academia as well as private sector representatives from most Argentine provinces and all Mercosur countries. The active participation of the FIG Commission 5 was crucial in facilitating between the different stakeholders during the workshop.

By the end of the workshop, there was unanimous agreement among participants that industry-government cooperation and federal leadership is required to achieve goals such as the development of:

- procedures that will guarantee the management and delivery to users of the spatial reference systems,
- geospatial positioning standards to describe and classify the accuracy of points in the national spatial reference system and
- procedures for the integration of the provincial networks to POSGAR98 and SIRGAS.

The debate initiated during the workshop has sparked a number of activities in the last couple of years:

- The IGM successfully pursued a reconfirmation of its role as had been defined in the Ley de la Carta in the year 1941. In 1997, a government decree reconfirmed the IGM as the national cartographic and geodetic authority.
- The Universidad Nacional de la Plata readjusted POSGAR94 to conform to SIRGAS specifications and produced POSGAR 98. It is not clear yet how the transition from

POSGAR 94 to POSGAR98 will be managed, or who will be responsible for the physical and mathematical maintenance of POSGAR (Moirano et al 1997, 1998).

- The first edition of “Geodetic Standards” produced in 1996 by the Subcommittee of Geodesy of the National Committee of the International Union of Geodesy and Geophysics is presently under revision. IGM will be responsible for the distribution of the final document.
- A working group under the same subcommittee is now preparing a document on geodetic network management; the document will be approved and disseminated by the IGM by the end of 1999.

Conclusions

The creation of a new order of things is a slow process. The Argentine example shows that for the change to be sustainable, the local professional community (academia and government) must drive the process in close cooperation with each other. Questions worthwhile addressing during the FIG Working Week in Sun City could be a) to what extent the Commission 5 of the FIG can continue acting as a catalyst in the process of change of the geomatics landscape in the developing world and b) what initiatives will the incoming US FIG Bureau consider in regards to the changing technical and policy processes in the field of geomatics in the Americas.

References

- Georgiadou, Y and E. Falcon (1996): “El futuro de las redes de control geodesico y los nuevos conceptos para los levantamientos catastrales,” Workshop report, September 30 to October 4, 1996, La Plata, Argentina
- Gillone, R. and C. Brunini (1998): “Echar una red grande: El Proyecto de Asistencia al Sector Minero Argentino (PASMA)”, *Geoconvergencia*, Julio 1998, pp. 28- 36
- IBGE (Instituto Brasileiro de Geografia e Estatística) (1997): “South American Geocentric Reference System SIRGAS Final Report,” Working Groups I and II, Rio de Janeiro, Brazil, 109 pages.
- IGDN (1997) – Internet website address:
<http://edcintl.cr.usgs.gov/igdn/>
- J. Moirano, C. Brunini, H. Drewes and K. Kaniuth (1997): "Methodology for the integration of the POSGAR network to the SIRGAS reference frame". Proceedings of the IAG Scientific Assembly, Rio de Janeiro, Brazil, 1997
- J. Moirano, C. Brunini, H. Drewes y K. Kaniut (1998): “Evolución del sistema de referencia argentino en el marco del proyecto SIRGAS”. Actas del V Congreso Internacional de Ciencias de la Tierra, Santiago, Chile, 1998.
- Nichols, S. and J. McLaughlin (1993): “National Spatial Data Infrastructures: opportunities, challenges and issues,” Fifth Colloquium of the Spatial Information Research Centre, University of Otago, New Zealand, May 17-19, 1993, 8 pages