Examining the Role of Partnerships in Building a Canadian Geospatial Data Infrastructure

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Key words:

ABSTRACT

Canadian federal and provincial government organizations have long been engaged in building and maintaining extensive collections of digital topographic mapping datasets, road network files and property mapping databases in support of their own respective mandates and obligations. Since 1996, a collection of these organizations has been instrumental in establishing and developing the Canadian Geospatial Data Infrastructure (CGDI) Initiative. Capacity-building and partnerships between different levels of government, industry and academia have been two of the hallmarks of the CGDI initiative. To this end, considerable emphasis has been placed on developing and promoting examples of collaborative agreements, and technology development projects aimed at expanding and enhancing the availability of geospatial data.

This paper will examine the nature and status of selected partnerships and institutional arrangements designed – either directly or indirectly – to help build the Canadian Geospatial Data Infrastructure. After describing some of the basic institutions involved, the author will focus on the 5-year, $60 million GeoConnections initiative, the GeoInnovations program, and the GeoBase Portal as examples of this cooperation.

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1. INTRODUCTION

Canadian federal and provincial government organizations have long been engaged in building and maintaining extensive collections of digital topographic mapping datasets, road network files and property mapping databases in support of their own respective mandates and obligations. Beginning in the mid-1980's, cooperative spatial data-sharing and cost-sharing arrangements at both the federal and federal-provincial levels were developed in support of accelerating several of these mapping programs.

Since 1996, a collection of these organizations has been instrumental in establishing and developing the Canadian Geospatial Data Infrastructure (CGDI) Initiative. Capacity-building and partnerships between different levels of government, industry and academia have been two of the hallmarks of the CGDI initiative. To this end, considerable emphasis has been placed on developing and promoting examples of collaborative agreements, and technology development projects aimed at expanding and enhancing the availability of geospatial data.

This paper will examine the nature and status of selected partnerships and institutional arrangements designed – either directly or indirectly – to help build the Canadian Geospatial Data Infrastructure. After describing some of the basic institutions involved, the author will focus on the 5-year, $60 million GeoConnections initiative, the GeoInnovations program, and the GeoBase Portal as examples of this cooperation.

2. COUNTRY CONTEXT

"If some countries have too much history, Canada has too much geography".
-- William Lyon Mackenzie King, former Prime Minister of Canada

Spanning 7000 km. from east to west, Canada is the second largest country in the world in terms of area. It has a population of approximately 31 million people, with more than 80 percent of them living in towns and cities within 250 kilometres of the United States border. Canada is a federation with a parliamentary system of government. Powers and responsibilities are divided between the federal government, the 10 provincial governments, and three territorial jurisdictions. In turn, municipal and regional governments operate within each province.

Canada has two official languages – French and English – with French being the mother tongue of over 20% of the population. There are three main groups of Aboriginal peoples in Canada -- the First Nations, the Inuit and the Métis. Now home to immigrants from over 240 different nations, Canada today is a very cosmopolitan country (CIC, 2004).

3. INSTITUTIONAL ARRANGEMENTS

3.1 Framework Data

Geomatics Canada[1], an organization within the Earth Sciences Sector of Natural Resources Canada (NRCan) has the national mandate for provision of *nation-wide* geodetic control, topographic mapping frameworks and the land survey system and cadastral mapping on Canada Lands[2]. The Canadian Hydrographic Service[3] (CHS) possesses the mandate for charting of Canada's coastal regions and navigable waters.

NRCan has been traditionally responsible for map production at scales of 1:50,000 and smaller, while provincial government organizations have handled scales from 1:20,000 up to 1:2,000. Where needed, municipal governments have been responsible for creation of mapping at scales of 1:1,000 or 1:500.

[1] Geomatics Canada Website URL *http://ess.nrcan.gc.ca/geocan/index_e.php*
[2] Canada Lands consist of approximately 2600 Indian reserves, the National Parks system (including historic sites and canals such as the Rideau and Chambly), the Yukon, Northwest Territories, Nunavut and offshore areas of Canada.
[3] Canadian Hydrographic Service Website URL *http://www.chs.gc.ca/pub/*

Overlapping activities do exist at each level – as well as *between levels* -- of government in Canada. Such federal organizations as Statistics Canada, Canada Post also collect medium- to small-scale road network information, for example, while Public Works Canada, Transport Canada and others have the occasional need for larger scale mapping. Environment Canada, Agriculture and National Defence also have project- and program-driven mapping requirements that cannot always be satisfied with existing information.

As well, there has been the perception of considerable overlap in geodetic control and topographic data collection at the federal and provincial levels (HAL, 2001). In an effort to coordinate efforts — or at least streamline cooperation towards the common goal of full and up-to-date coverage — a variety of different strategic arrangements were developed and implemented over the past 15 years (Coleman, 1999).

3.2 Land Administration Activities

Except for Canada Lands, provincial governments[4] are usually responsible for production and distribution of cadastral (property) mapping, while property valuation and taxation may be either a provincial or local responsibility. Excellent integrated examples of such activities may be found in most provinces, although they may not be immediately apparent from the government Websites since many service their customers on a password-protected, subscription basis.

In partnership with other government organizations, the Legal Surveys Division[5] of NRCan supports the operation of the federal and territorial property rights systems on Canada Lands. The Surveyor General's Office within the Legal Surveys Division sets, maintains and updates survey standards, maintains and provides access to the Canada Lands Survey Records, establishes a regulatory regime, and manages both the digital cadastral databases and ground-based survey frameworks.

While communication exists through strong professional networks and informal relationships, there is no requirement for regular operational contact between the land administration organizations in different provinces. Moreover, various local, provincial and even federal organizations have responsibility for managing their own properties. These organizations may originally obtain basic information from the relevant organization in the province(s) in which they operate. However, most will subsequently update their own attribute records and, in some cases, offer property map databases on their own web sites.

3.3 Coordinating Committees and Consortia

Over the past forty years, Canada has built a strong collection of institutions to govern geomatics activities at the federal and provincial levels. Each of these organizations has evolved over time in the face of changing political and socio-economic conditions in their respective environments.

[4] See *http://www.geoconnections.org/CGDI.cfm/fuseaction/partners.welcome/gcs.cfm* for a list of links to provincial government mapping organizations in Canada.
[5] See *http://www.lsd.nrcan.gc.ca/english/index_e.asp* for details on the Legal Surveys Division.

3.3.1 Inter-agency committee on geomatics

The Inter-Agency Committee on Geomatics[6] (IACG) was founded in 1988 to encourage coordination of federal geomatics activities. Current members include all of the key federal organizations involved in the collection, management and application of geospatial information. Recent activities include the adoption and implementation of standards and policies.

3.3.2 Canadian council on geomatics

In 1971, a Canadian Council on Surveys and Mapping was established to provide a forum for formal discussions and mutual support among the directors of the surveying and mapping programs across Canada. Renamed the Canadian Council on Geomatics[7] (or CCOG) in 1996, its members include representatives from key federal agencies, as well as from topographic mapping programs in every provincial and territorial government. General policies promoting collaboration between federal and provincial geomatics organizations are coordinated through the CCOG, and this organization played a key early role in defining and promoting the need for a Canadian Geospatial Data Infrastructure in the mid-1990's (Loukes et al., 1996).

3.3.3 Geomatics industry association of Canada

The Geomatics Industry Association of Canada[8] (GIAC) is a national business association dedicated to serving the geomatics industry in Canada. While membership is voluntary and does not include all geomatics firms in the country, GIAC's members include almost 100 of Canada's leading geomatics service and technology firms, and approximately 80% of the active exporters in this sector

3.3.4 Geoide network of centres of excellence

The GEOIDE Network of Centres of Excellence[9] was established in 1999. With a multimillion-dollar annual budget, its mission is to take advantage of Canada's capabilities in university-based research and development in order to develop strategic alliances between industry, government and academia, thereby consolidating and strengthening Canada's overall geomatics sector. While not representing all the universities involved in geomatics research and education in Canada, it has played a major role in bringing together geomatics researchers from the three sectors over the past five years.

3.4 Early Examples of Partnerships

Until the late 1970's, most federal and provincial government surveying, mapping and land administration activities were conducted in-house. Private sector involvement in such

[6] See *http://www.geoconnections.org/CGDI.cfm/fuseaction/partners.iacg/gcs.cfm for details on IACG.*
[7] See *http://www.geoconnections.org/CGDI.cfm/fuseaction/partners.ccog/gcs.cfm for details on CCOG.*
[8] See *http://www.giac.ca/site/index.cfm* for details on GIAC.
[9] See the GEOIDE Website URL *http://www.geoide.ulaval.ca/en/home/home.html*

programs began by sub-contracting production services under close government supervision. By the late 1980's, most front-end surveying and mapping production capabilities had migrated from the public to the private sector and Canada had a thriving geomatics services sector.

As the focus of such programs eventually moved from data collection to database management and updating, government priorities changed as well. While some base mapping requirements still exist, industry can no longer rely on the base loading of long-term provincial and national mapping programs of past decades. Most geomatics data collection projects tend to be smaller and short-term in nature. Longer-term relationships were now forged with software developers and systems integrators. Some provinces (e.g., New Brunswick) moved to more extensive arrangements involving quality control and project database management, while others developed even more far-ranging public private partnerships for land administration (e.g., Teranet in Ontario).

Relationships with academia varied across the country and depended in large measure on personal relationships and the proximity of relevant university programs to centres where substantial activity and investment in geomatics. For example, relatively tight institutional relationships developed between industry, government and academia in Canada's Maritime Provinces (UNB), Quebec (Université Laval) and Alberta (University of Calgary) – each of which had well-established university programs, significant government investment, and substantial geomatics planning and production underway from the 1970's onwards. Groups in other regions which did not have such extensive programs relied upon personal contact between individual academic researchers and senior managers in government and industry.

4. BUILDING THE CANADIAN GEOSPATIAL DATA INFRASTRUCTURE

As can be seen from the above sections, Canada possesses an impressive collection of geomatics and land administration programs. However, many of these programs are not integrated and some in fact overlap with one another. It is also apparent Canada has developed substantial expertise and capacity in geomatics program planning, production, sensor and systems development, operations management, and R&D over the past fifty years – a capability out of all proportion to its relatively small population and GNP. That said, the capabilities were distributed across many different – and sometimes competing -- organizations spread across a large country. As well, some of the capabilities were based on technologies or markets in decline and were not necessarily based on any international standards.

These strengths and limitations have long been recognized, and a number of federal and provincial projects have attempted to address these over the years. However, these projects have typically been "one-of" in nature and enjoyed limited short-term funding. By the 1990's, there was a collective will to pursue a larger vision.

4.1 The Canadian Geospatial Data Infrastructure (CGDI)

Spearheaded by the IACG and CCOG, the Canadian Geospatial Data Infrastructure initiative was launched with the intention of "… enabling timely access to geospatial data holdings and services in support of policy, decision making and economic development through a co-operative interconnected infrastructure of government, private sector and academia participants" (Loukes et al, 1996). The basic "Principles for Data Partnership" implicit in CGDI include (from Labonte et al. (1998)):

- Data should be collected once, closest to the source and in the most efficient way possible, with a view towards increasing the vertical integration of the data.
- Geospatial data should be as seamless as possible, with coordination across jurisdictions and boundaries when possible.
- Data should be collected, processed and maintained according to international standards to maintain data integrity across databases, and to enable the addition of value, further enhancement, and easy access and use.
- Upon agreement, partners should contribute equitably to the costs of collecting and managing the data, and should be allowed to integrate the resulting information into their own databases, for their own use and for further distribution to their stakeholders.
- There should be an attempt to harmonize terms and conditions for use where practical. In the absence of such agreement, each agency should be free to establish its own terms and conditions for such information.
- Agreements between agencies will normally be negotiated on a case-by-case bilateral or multilateral basis, according to these principles of partnership.
- Partnerships between agencies should be simple and support the principles of the CGDI, open to the participation of interested stakeholders within any level of government, the education communities or the private sector.
- A group or agency within each province and within the federal government should be designated to promote and co-ordinate the development of a common geospatial data infrastructure, both within its jurisdiction and between jurisdictions.
- CGDI is national in scope, and must meet the needs of a wide range of geospatial user communities, data producers, and different areas of the private sector.
- CGDI must consist of a set of coordinated and interrelated policies, practices and possibilities that build on the vision.

The five key thrusts of CGDI are illustrated in Figure 1 (Labonte et al., 1998).

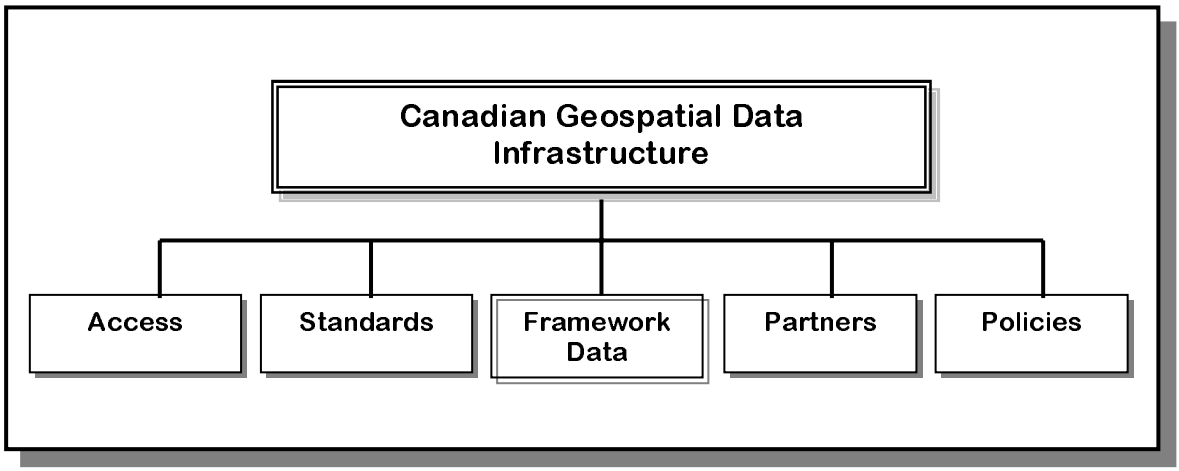

Figure 1: Five Thrusts of CGDI (Labonte et al, 1998).

4.2 The GeoConnections Program

Elements and spinoffs from Canada's GeoConnections[10] program provide excellent examples of partnerships between government, industry and academia. In 1999, GeoConnections was allocated $60 million Cdn in federal funding over six years to implement the CGDI through seven major projects.

Masser (2003) provides an excellent comparative overview of GeoConnections in relation to its counterparts in the USA and Australia. Staff support for GeoConnections is provided by Natural Resources Canada. A Management Board consisting of senior government officials from the IACG, the CCOG, and representatives from academia and industry guides its work. It is chaired by the Assistant Deputy Minister of the Earth Sciences Sector of Natural Resources Canada.

Surprisingly, the focus of GeoConnections is not data collection, although framework data is an integral part of GeoConnections. Quite the contrary, with shared leadership most of the programs within this initiative revolve around network design, ideas for institutional change, the development of common policies, capacity building, the creation of partnerships, and the promotion of data access and sharing through promoting development and use of standards-based products and services (GeoConnections, 2003). These particular goals are common to other programs within Geomatics Canada, as well as in provincial programs as well.

4.3 Capacity Building

The geomatics companies of a generation ago specialized in data collection. At least in the Canadian market, today's specialists must develop products and services that operate in a "data-rich" environment. As a result, there is a requirement to build expertise in developing

[10] See the GeoConnections Web Site at *http://www.geoconnections.org/CGDI.cfm/fuseaction/home.welcome/gcs.cfm*.

standards-based systems and processes that find, import, manage, manipulate and display geospatial data.

The GeoInnovations[11] program within GeoConnections was designed to provide seed funding to companies interested in developing such expertise. Over the past five years, GeoInnovations has funded more than 70 different projects – some of them partnerships between industry, government and/or academia – in developing products, applications and expertise that are now being marketed internationally.

As well, substantial funding has been directed towards encouraging more astute and intensive usage of geospatial data in different communities of practice. These target areas have included resource management (in northern communities in particular), ground transportation, disaster management and marine issues.

Results of this funding have been mixed. Clearly, a growing number of software firms across Canada now offer competitive, state-of-the art products that conform to international standards. A limited number of these firms (e.g., Macdonald Dettwiler, CARIS, Compusult, the DMR Group and SAFE Software, among others) are large enough to compete and offer their products and services internationally. However, smaller firms are also now working with international partners in commercializing their concepts into stand alone products or add-ons to larger commercial products.

4.4 Creation of Partnerships

The notion of "Partnerships" in the Canadian geomatics community covers a wide spectrum. For example:

- Advisory boards and program advisory committees for Geomatics Canada and selected provincial initiatives involve representatives from the private sector, other levels of government, professional associations, and academia. As well, at least three major university geomatics programs across Canada have also included members of private companies and government departments on their program advisory boards.

- Members of academia and the private sector have played significant roles in defining and developing key aspects of programs like GeoConnections through undertaking sabbatical leaves at NRCan and conducting front-end consulting projects[12].

- Federal and provincial government departments work together across the country on a project-by-project basis to identify specific areas where data may be collected only once and used by both groups.

- Key contributors from industry and government have controlling interest of the Board of Directors of the GEOIDE research network mentioned earlier. In addition to the

[11] Good descriptions of all 72 GeoInnovations projects may be found at *http://www.geoconnections.org/CGDI.cfm/fuseaction/projects.programs/pgm_id/1/gcs.cfm.*

[12] The "Publications" section of the GeoConnections Web site contains numerous examples of such projects.

university researchers, most GEOIDE R&D projects must by definition include the active participation of representatives from a major user (often government) and – for eventual commercialization -- a major industrial partner.

One of the most ambitious examples of partnership development has been the implementation of the GeoBase Portal[13]. A partnership between federal and provincial government mapping organizations, GeoBase brings together data from both federal and provincial sources to provide Canadians with free Web-based access to national road network information, digital elevation models, satellite imagery and, soon, hydrology information across the country.

Still in its early stages, GeoBase nevertheless represents a significant milestone in cooperative collection and distribution of Canadian digital topographic mapping. While employing state-of-the-art Web-based technology, GeoBase is regarded by practitioners as primarily an *institutional* rather than technological accomplishment. The present version of GeoBase was created only through a series of individual negotiations between NRCan and representatives from each province. Each negotiation covered a similar set of technical and institutional concerns, but the details of operational priorities, reprocessing costs, pricing and distribution policies, and incentives differed in every case.

5. CHALLENGES

Canada has been recognized traditionally as a country with a relatively small number of strong geomatics institutions. This environment has worked to Canada's benefit in times of stability:

- It has encouraged dialogue and sharing across jurisdictions;
- it promoted the development of a strong services industry;
- it has encouraged the rapid coverage of the inhabited portions of the country with superb control networks, several base mapping series, and a strong land administration infrastructure.

In short, it has provided Canadians with on line access to an impressive amount of relatively consistent and compatible mapping and parcel-based information.

This environment of a limited number of strong institutions, however, can also impede progress in times of change:

- Large organizations develop their own agenda for survival and influence that can and do interfere with negotiating the most appropriate cooperative arrangements;
- Not all decisions can result in "win-win" scenarios – especially when balancing regional differences, differing needs of federal and provincial government partners, and differences between the status and capabilities of different companies within the industry;

[13] See GeoBase Portal URL *http://www.geobase.ca*

- Partnerships and consensus take a long time to build, and slow but steady progress on some shared initiatives may not satisfy the short-term requirements of some potential partners or their stakeholders.

Finally, when public health care consumes an increasing share of government budgets and the public's attention, it has become increasingly difficult getting senior decision-makers to continue funding geomatics activities as a necessary and authoritative basis for effective administration, resource management, emergency response and homeland security.

6. CONCLUDING REMARKS

In this paper, the author has attempted to provide a snapshot of the current structure and activities of the institutions -- and challenges facing the community -- in the cooperative creation of a Canadian Geospatial Data Infrastructure. Much has been done over the past five years to initiate the dialogue, build support, and reinforce the core principles of the initiative. While sometimes frustrating, the results of the capacity-building, the continued cultivation of partnerships, and the patient consensus-building among key stakeholders has begun to bear results.

That said, CGDI is still very much a fragile "work in progress". The degree to which the vision, relationships and agreements developed over these first five years can be sustained will determine the real success of the CGDI effort.

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