Geomatics Convergence

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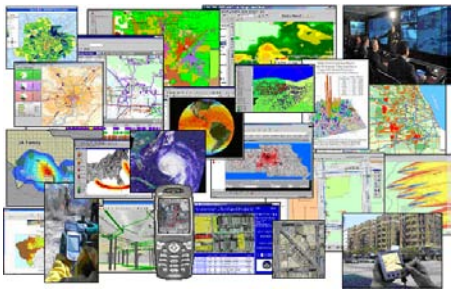
Convergence is essentially the coming together of two or more disparate disciplines or technologies. There are numerous examples of this in the previous century including the ever-present facsimile machine, resulting in the convergence of the technologies of telecommunications, optical scanning and printing. Early in this century we are likely to see the convergence of television and the Internet. This convergence of technology facilitates the convergence of disciplines, and nowhere is this more apparent than in the geomatics industry.

Geomatics has been defined as the art, science and technologies related to the management of geographically referenced information. Geomatics has also become an umbrella term for the science of surveying, and includes all current survey branches; cadastral, hydrographic, photogrammetric, geodetic and geographic information management.

Geography is the science of representing our world. Geographic Information Systems (GIS) is the technology for acquisition, processing, analysis, presentation and storage of geographic data. GIS is also becoming the language of geography, as relevant as the written word for communication, music notation for music or algebraic notation for mathematics. This language integrates disciplines, organizations, information, processes, plans, workflow and decision making under a common framework.

The plethora of applications in the GIS realm provide the evidence of the power of this collaboration. Just of few of these applications include systems for assessment and valuation, combining parcel mapping with asset databases and real estate information; utility operations and maintenance, combining asset infrastructure with billing databases and outage information; community planning, combining infrastructure requirements with three dimensional visualization for sustainable and livable communities; transportation planning and routing, combining street network information with planned closures and live traffic information and mobile precision farming, combining global positioning with agricultural information in handheld devices enabling "just in time" harvesting. In addition to traditional two-dimensional mapping, whole earth visualization is emerging providing a new context for visualizing our impact on the world as a whole and for communicating this message to others. Handheld systems are bringing all of this information directly to the site of interest on technology of choice, whether it is a cell phone or PDA.



The Need for Data

With the many applications comes ever-increasing demand for geographically referenced information. What GIS users need is better geographically referenced data to support their applications and decisions. This data needs to be more positionally accurate, timely (i.e., up-to-date) and relevant to the task at hand (i.e., properly structured and available to the applications). Therefore GIS users need knowledgeable professionals whose job it is to provide this accurate, timely and relevant data.

Because decision makers rely on GIS, they require an accurate underpinning for their data. This underpinning is the integrated cadastre. The integrated cadastre needs to be managed as an infrastructure, providing up-to-date positional information for other related GIS information. Surveyors are uniquely positioned to provide this foundation; planners are users of the data not custodians, engineers are focused on detail not the overall picture.

The government of Canada is currently building the Canadian Geospatial Data Infrastructure. The concept is to capture data once closest to source. This exercise is funded through GeoConnections, with $60 million funded from 1999 to 2004 and another $60 million for 2005 to 2012. The national program is run by Natural Resources Canada with federal / provincial collaboration. Its purpose is to make geospatial data widely available. The first step is a national base map called Geobase (www.geobase.ca), which provides free access to road network, administrative area, satellite imagery and elevation data.

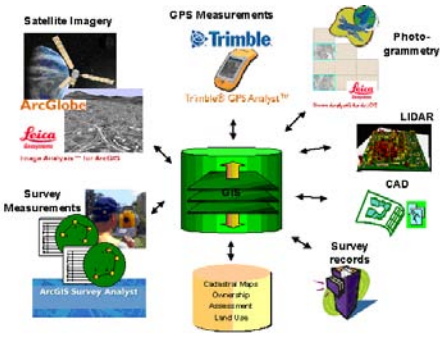
In Ontario, Land Information Ontario provides Ontario's Geospatial Data Infrastructure. There are many data layers available in a warehouse constructed with many suppliers. Some layers are freely available, some are fee based. Core data layers are the Ontario Base Map, Ontario Parcel and the Ontario Road Network. This data is available to the public via distributors. ESRI Canada currently serves up Ontario Base Map (OBM) data to the public via a free map service (www.geographynetwork.ca/website/OBM).

These data infrastructures will ultimately form the basis for location services to the public. Note that this is the first time in the history of GIS in Canada that reasonably accurate base data is available for free, which finally brings us on par with the United States in the availability of government collected base data. In the United States this has spawned many value-added data and application products, and it is likely to do the same for Canada.

In returning to the theme of geomatics convergence, it is obvious that the geomatics disciplines are converging. A geomatics professional of the future will need to employ whatever tools are necessary to complete the task at hand. Moreover the lines between the disciplines are blurring, ultimately there will be less of a distinction between cadastral, photogrammetric, hydrographic and geodetic surveyors and geographic information managers.

Technology Driving Convergence

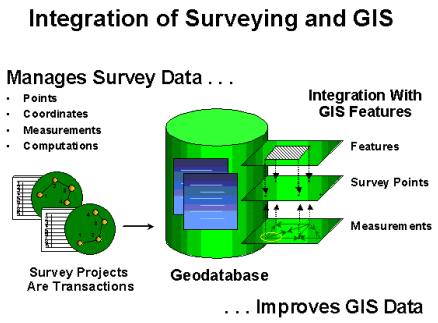
In many ways technology is driving this convergence. GISs are now storing and analyzing more survey related information including survey measurements, orthorectified imagery (satellite or airborne), GPS raw and processed data, LIDAR (light detection and ranging) raw and processed data, computer aided drafting (CAD) drawings and survey records. Each of these tools may be used by many of the surveying disciplines, further harmonizing the different survey disciplines.



Surveyors have always been early adopters of technology. Surveyors were one of the first users of computers in 1948 for control network adjustment. Electronic distance measuring devices were first employed in the 1950's. The first electronic calculators were used by surveyors in the 1970's. The late twentieth century brought the advent of global positioning technology, robotic total stations, CAD, LIDAR and GIS. GIS is the basic technology for managing and manipulating geographic information and is thus core technology for geomatics.

The act of cadastral surveying is to establish, locate, define or describe lines, boundaries or corners of parcels of land or land covered by water. This is also important for users of GIS. The GIS community needs surveyors to define the digital cadastre, to integrate the cadastre with GIS, and to ensure that related data is linked to the cadastre. Note that there are some standards emerging for cadastral information, in particular the Fédération

Internationale des Géomètres (FIG) Cadastre 2014 standard.



Surveyors are digital cadastre creators. In addition, municipalities, land registry, assessment, utilities, transportation, natural resources (crown leases) and Natural Resources Canada for federal lands also contribute to the digital cadastre. Digital cadastre users are municipalities, including planning, engineering, building, public works, legal, tax and economic development departments; municipal affairs, land registry, assessment; utilities, including telephone, electricity, television and gas; transportation, agriculture and developers. Other users include insurance companies, banks, port authorities and real estate companies.

Cadastral Initiatives Across Canada

The federal government and various provinces are currently working on initiatives to produce the digital cadastre. Natural Resources Canada is currently working on a National Cadastre. British Columbia has created the Integrated Cadastral Initiative Society: a cooperative of the province, municipalities and utilities, to produce a province wide cadastre. Alberta has the Spatial Data Warehouse; which contains cadastral data for the entire province. The Saskatchewan LAND (Land Titles Network Delivery) project delivers digital registration tied directly to a digital cadastre. The Ontario Parcel provides digital ownership, assessment and crown land for the province at various levels of accuracy and completeness. The Quebec Cadastral Reform project has resulted in an accurate up-to-date cadastre for the entire province integrated with registry. In the Maritimes, the Land Related Information Service (LRIS) provided a digital parcel base initially collected from photography and is now updated by coordinate geometry for new plans by the individual provinces.

It is worthwhile to look at a few of these initiatives in more detail. In BC the Integrated Registries project is the umbrella project for cadastral initiatives. The province is currently implementing digital plan submission where the digital plan is submitted in LandXML (an XML encoding of survey data developed initially by Autodesk). These digital plans will be used to incrementally improve a provincial wide cadastre tied to control. The idea is that each new plan would add additional information to the cadastral base, and the base would be readjusted using least squares.

In Alberta, digital cadastre update is funded by a $100 plan submission fee. AltaLIS, a private company, maintains the cadastre using digitally submitted plans in CAD format. Currently all cadastral updates outside Calgary and Edmonton are complete within 24 hours of submission. There are 1.3 million parcels in Alberta outside Calgary and Edmonton with 1,000 new plans registered per month. New plans are integrated using in-house least squares adjustment, resulting in an incrementally improved fabric. The 24-hour turnaround for cadastral updates is achieved with only 6 full time staff and management.

An interesting project is currently underway in Newfoundland. The Newfoundland Land Surveyors unanimously passed Bylaw 18, which mandates the digital submission of new plan information to a registry system designated by the Association of Newfoundland Land Surveyors. The rights to the digital cadastre are retained by the association, with the rights to the original documents retained by the authoring surveyors. The new registry system will be fee based, and portions of the fee will be distributed proportionately amongst the association, authoring surveyor and the registry system. This project has just begun, but it holds promise for the possibility of surveyors regaining control of the digital cadastre.

Other Opportunities

Beyond the digital cadastre, other opportunities are available to the new geomatics professional. New technology like LIDAR and digital elevation models from photography can be used to generate new business. The Focus Group in Alberta uses GIS and digital elevation models for topographic surveys and preliminary road design. As-built drawings can also be maintained with GIS. Most utilities and infrastructure need as-built data. This data was traditionally kept on plans (manual or CAD). GIS provides a database that can be updated by transaction. This information can be used to address the asset management information requirements of Bill 175 in Ontario.

Surveyors can also use GIS technology to manage their own businesses. GIS provides a spatial index to survey records providing proximity searches for jobs. CAD files can either be stored on a file server or in a database and retrieved on demand. Notes and scanned plans can also be so indexed. For example, the Focus Group was able to reduce searching time for a job from 25% to 5% using GIS. Managing a firm's survey records is also a way of getting into GIS on a small scale, leading to further opportunities for GIS use in the future.

The surveying and GIS industries are also converging. ESRI has held a Survey and GIS Summit for the last two years overlapping its International User's Conference and will be holding the summit again this year in July. This summit focuses on survey related issues and is open to all surveyors, whether they are users of ESRI technology or not. This summit attracted almost 400 attendees the first year and over 450 the second year from all over the United States and the world. One thing that is apparent from these summits is that the same issues exist for all geomatics professionals around the world and that solutions in one place may be applicable in others.

The future definitely holds possibilities. The GIS industry has been a steadily growing market for the past 20 years. The surveying and geomatics industry can bring GIS to a whole new level, where GIS is used for timely, mission critical applications. The convergence of geomatics and GIS will allow surveyors and their customers to embrace this future.