

GIS and The Future of Surveying

By Dave Martin Horwood, BSc, O.L.S. and G. Brent Hall, PhD, MNZIS

Walking an invisible line

Requires knowledge, judgement and skill

Beware the barking dogs

- DMH 2012

There has been a flurry of recent activity and discussion within the international surveying community around the future of the profession. These exchanges are really no different than similar discussions that have appeared occasionally over the last decade. In fact, the dialogue extends back even further, into the mid-1990s (see, for example, in the context of survey education, Frank (1995)). Despite the recognized need to find identity and place in a world of growing geospatial information complexity and ubiquity, there has been only minor progress toward charting a clear path for surveying and surveyors into the future. The need to make more progress on this front is now more urgent than in the past, and the urgency will accelerate rather than abate over the next ten to twenty years.

The surveying profession, more so than other professions, is feeling acutely the weight of the demographic shift of the baby boom generation as it passes from active participation in the workforce into retirement. In Canada, for example, by 2030 the population over the age of 65 will double, while, in contrast, the working age population (25-64) will increase by only 8%. Members leaving the survey profession are already outstripping the rate of new members entering from higher education, and unless specific steps are taken this problem will increase. In 2011 the number of 18-21 year old Canadians peaked, and will gradually decline until it rebounds by 2030. Through to 2024, the 52% of full-time higher education enrolments in the 18-21 age group (52% of total enrolments) will decline by approximately 10%, and all provinces and territories will experience a loss in potential demand for higher education. This reality is compounded by the fact that higher education surveying programs are struggling worldwide to attract new student enrolments, and the public perception of surveying is not so much that of a viable profession that supports multi-faceted professional activities but as that of a trade that is a necessary evil as part of the land development process. This perception is likely embodied in the perception of the surveying brand, which for well over a century served the profession admirably, as involving individuals, almost invariably males, using tripods and measurement instruments. However, this branding now is far less relevant and accurate as a portrayal of the overall work of a modern surveyor, most of which is now done back in the office as opposed to in the field. In the next twenty years, the surveying profession will be

even more challenged to bolster member retirements due to generally declining tertiary enrolments of Canadian students, compounded by the challenges the profession faces in terms of its public image.

The article “Perspectives on the Future of Surveying” by A. Richard Vannozzi (2011) (<http://surveysummit.com/2011-proceedings/files/perspectives-future-surveying-profession.pdf>), articulates the view that the current scope of the surveying profession consists of three activities, namely boundary (cadastral) surveys, data accumulation surveys (e.g., topographic, LiDAR, photogrammetry, utilities) and construction layout. In the latter two activities, surveyors have faced and are continuing to face increased competition from other related professions and trades. The so-called “sacred cow” of the survey profession, the cadastral survey, has also come under public scrutiny, where it is now not uncommon for potential clients to opt for more expedient products like title insurance in lieu of a survey. At the same time, government agencies are also assembling parcel maps in response to the need of more efficient forms of land administration, and these activities have the potential to replace some of the traditional uses of a cadastral survey.

Beyond the public arena, and as noted above, the general field of surveying, both as an area of higher education and as a professional activity undertaken by ‘land surveyors’, ‘hydrographic surveyors’ or, more generically, ‘survey professionals’, is also experiencing a problem with its brand. The label “geomatics” was enthusiastically adopted during the 1990s by the surveying profession worldwide, yet this term has no resonance with the public and is divorced from the well-known brand of land surveying, which is also not without its own challenges in terms of perception. Surveying programs in educational institutions throughout the world during the 1990s and into the 2000s undertook a rebranding and department names were replaced with labels such as geomatics and geomatics engineering. The word “geomatics” itself really just means “related to the earth”, and as such it is a rather nebulous distinction that has failed to resonate with students or with the public. Moreover, the word has also been adopted by the engineering profession, further diluting the surveying brand. More recently, tertiary institutes in Australia have opted to return to the “surveying” brand, as this more accurately articulates what surveyors do day-to-day in their work. In this context, the act of surveying is *to observe critically and measure the real world* and *to form a professional opinion*. In our view, this is where the brand and the profession

cont'd on page 8

both have their greatest investments not only in the past, but also in the future.

Whereas the surveying profession is experiencing, on the one hand, challenges in attracting new entrants and, on the other hand, a constricting market with increased competition, the geographic information systems (GIS) market has shown continued and accelerating growth. GIS, also known currently as Geospatial or Geographic Information Science, comprises the information systems and tools used to organize, manage and analyze objects based on location and relationship with other objects in the real world. The growth in GIS has been steady and continuously upward over the last 25 years, even through downturns in the global economy. With its focus on software and its applications across multiple domains, GIS has no problem attracting new practitioners and is beginning to become a critical part of all businesses information technology (IT) infrastructures from local to national enterprises. Location information is now part of almost all information collected, including personal photographs.

Some surveying associations have seen this trend and have attempted to capitalize upon it by embracing not only GIS but the more broadly defined knowledge base and skills that are centred within the geospatial sciences. The Association of Ontario Land Surveyors (AOLS), for example, added in 2001 the Geographic Information Management (GIM) branch and currently has about 60 members with this designation. However, the AOLS is still struggling with articulating what this designation means, whether members with GIM credentials should be licensed, how a GIM relates to cadastral surveying, how the GIM value proposition can be best articulated to the large cadre of students exposed to GIS in higher education, or what benefits exist for current GIMs that will encourage them to renew their designation.

Surveying, Professionalism and GIS

Surveyors traditionally have been relied upon to provide accurate measurement to the exclusion of almost everything else that the profession provides above and beyond the trade (i.e. the value added by professional opinion to the trade of accurate measurement). However, by concentrating on measurement they may have abandoned to other professions and trades important aspects of the roles that the surveyor has traditionally held, ostensibly as *the trusted land advisor*. Up until the relatively recent past, the surveyor was generally regarded as the director, guiding all stakeholders through the land development process. However, slowly at first, but much more rapidly recently, accurate measurement has essentially become commoditized, so much so that a minimally trained technician can, using modern instrumentation, faithfully measure and stake out survey grade locations.

Clearly, there is much more to the process of surveying than measurement. In fact, it is with this point of realisation where the field of surveying becomes transformed from simply a task-based trade into the realm of professional activity practised by survey professionals. To perform the tasks required of

him or her fully and with due diligence a surveyor not only measures the land or sea floor but must also research the legal record and other surveyor's opinions of the area being surveyed, visit the location to find evidence and recreate that legal record on the ground, and *form his or her own professional opinion as to the physical and conceptual extent of title*. In all jurisdictions, a licensed surveyor is the only legally qualified professional who can form this opinion and is also held legally liable for the same.

Extending the activities of the professional surveyor into the broader context of the geospatial information sciences, the question of whether GIS itself also constitutes a profession is of central importance. There are both proponents and opponents to the view of GIS as a profession, or even as a discipline or field, nevertheless in the early 2000s, the Urban and Regional Information Systems Association (URISA) consolidated yet earlier discussions and introduced a GIS Professional (GISP) certificate. The certificate, now managed by its own institute (<http://www.gisci.org/index.aspx>), has a five-year term and professional development requirements for renewal. There are approximately 5,000 members worldwide, however most of these members are registered and likely resident in the United States (US) (95%) and were grandfathered into the program for critical mass (80%). New certifications have definitely slowed since the end of the grandfathering period in 2009 (averaging 400 new certifications per year for the last three years). It remains to be seen whether there will be a large drop off in numbers once grandfathered members need to recertify, but based on current rates the membership will drop to 2,000 members by 2017. This represents less than 1% of the total estimated number of Geospatial Information Scientists and Technologists in the US in 2010 (210,000). There is a similar certification proposal put forward by the Canadian Institute of Geomatics (CIG), however this has had even less success, possibly because 195 of the GISP certifications are Canadian and at least two provincial survey associations have a GIS branch to their membership (Ontario and Saskatchewan).

As with any and all professional designations, there is a danger of falling into the credentialism trap where credentials become commonplace, littering business cards with long lists of designations. When credentials are multitudinous, ubiquitous and borne out of a need for identity and competition they lose their significance and credibility. Also, efforts to define the GIS 'profession' are analogous to earlier efforts to define the field of Computer Science as a profession. Very much like GIS, Computer Science has been trying to create a value proposition for a computer profession and regulatory body. Computer Science is a much larger more clearly demonstrable field than GIS and practitioners have been attempting to articulate the need for a computer profession for at least a decade longer than GIS practitioners with little success.

There are a number of other initiatives that seek to articulate the GIS body of knowledge, in particular the Geospatial Technology Competency Model (GTCM -

cont'd on page 10

<http://www.careeronestop.org/CompetencyModel/pyramid.aspx?GEO=Y>), in a way that realizes core competencies and skills that may be realized in workplace employment. This model attempts to articulate the competencies required to be a GIS practitioner. It divides industry-sector technical competencies into three areas, namely positioning and data acquisition, analysis and modeling and software, and application development. There is an unmentioned fourth area dealing with presentation and distribution. The field of Surveying clearly overlaps the first area and could partially overlap the second depending on the value added nature of the professional opinion. Despite these various initiatives, there is no overarching profession that encompasses all GIS activities. In this respect, perhaps GIS is more a way of looking at the world, or an expanded set of competencies that enhance existing professions than a profession in and of itself.

To place this discussion within a framework that recognizes the role of all disciplinary or core competencies, including surveying, involved with land and its development, it is necessary to include a number of other professions or quasi-professions that play a role in the land development cycle. These include the professions of planning, architecture, engineering and surveying. Generally this cycle begins with a survey of the land to be developed. Conceptually, following this planners create a plan for the land, architects design the development, engineers oversee the construction and realization of the design and surveyors resurvey the land to reflect the new development. However, the process is cyclical, sometimes iterative between steps and all professions interface with each other during the transformation of undeveloped land into some form of human habitation and use. At the core of this framework, geospatial information science and GIS practitioners facilitate the integration of information at each of these steps and can help manage the transfer of information between other professions and professionals along the way (see Figure 1).

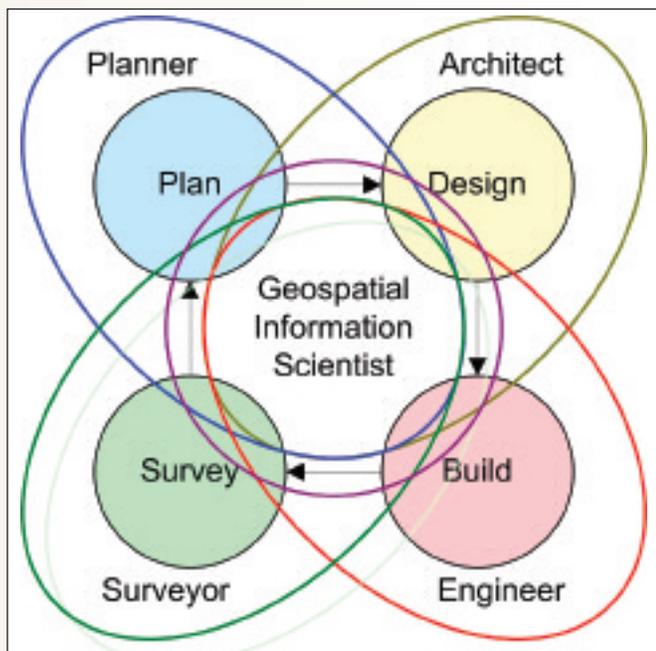


Figure 1: The Land Development and Management Process

In this conceptualisation the geospatial information science domain overlaps all of the land development related professions. Each of the land development professions also have overlapping domains, for example, in Ontario, site drainage is a shared domain where architects, engineers and surveyors are all legally qualified to prepare a site drainage plan. However, we believe that relative to the professional ‘orbits’ revealed in Figure 1, the surveying profession should be particularly interested in where the domains of GIS and surveying intersect and that very clearly there is an important GIS part of surveying that is not currently being addressed as adequately as it should be in current education programs for professional surveyors. We further feel that inclusion of this missing dimension in surveying curricula and recognizing it explicitly in professional surveying designations has the potential not only to broaden the dwindling ranks of professional surveyors, but also to provide professional credibility for GIS practitioners by embracing them more explicitly within the profession of surveying.

As part of the process of articulating the competencies of a GIM within the current AOLS designation, we have identified the following high level competencies for a geospatial information (GI) surveyor:

- Mathematics / Statistics
- Computer Science
- Introductory knowledge of survey methods / disciplines (cadastral, geodesy, hydrography, remote sensing – satellite, photogrammetry, LiDAR)
- In depth knowledge of GIS.

Given this premise we have analyzed a number of university surveying and GIS programs across Canada and one in New Zealand and scored them against the above proposed set of competencies, spread across courses in current undergraduate curricula. The resulting scores are still preliminary and need to be validated with the analyzed institutions. However, during this exercise we found that the survey programs matched quite well (80%) with the competencies, only missing in depth GIS and introductory computer science. The GIS programs on the other hand did not stand up as well (60%) and were missing a lot of positioning science as well as introductory boundary law and legal tenure courses. What is interesting from this exercise is that the concept of a GI surveyor with the proposed competencies has 80% of the educational requirements that would lead them to becoming a licensed cadastral surveyor.

Surveying associations and institutes, in dealing with an expanded profession, have in some cases taken a reductionist view. In Ontario, for example, non-cadastral branches (GIS, geodesy, hydrography and photogrammetry) of surveying are given a “Certificate of Registration” like cadastral members, but not a licence. The Ontario Surveyors Act (1990) articulates the branches specifically, requiring a legislative change to change or add new branches. Engineering, on the other hand, uses an “ethics-based” approach to regulating the profession. All engineers are licensed and are governed by their own code of ethics and overseen by the regulatory body

to ensure they are not practicing outside their domain of professional competence.

Resurrecting the Surveying Brand

Cumulatively, the above discussion and our general intuition suggests that surveying needs to expand its scope and re-establish the brand within this broader domain to encompass surveying-related parts of GIS. This path has been followed in Australia and is currently under discussion in New Zealand, and it should be high on the agenda in the various constituencies across Canada. Surveying needs this rebranding to make the profession more attractive to potential new members in order both to grow the industry and to keep it vibrant during the challenging times that lie ahead. Students need to see a vast number of potential options in practicing surveying, well beyond the traditional realm of boundary retracement. We believe that Australia and New Zealand are following the correct path by distancing surveying from the “geomatics” label and resurrecting the “surveying” brand centred within the geospatial sciences. After all, surveying was the first profession in the US and George Washington, Thomas Jefferson and Abraham Lincoln were all land surveyors before entering politics. The Australian surveyors have coined the motto “life without limits” (<http://www.youtube.com/watch?v=l-QufqAeFyM>) for their marketing to students, which we feel resonates more with potential practitioners than the current mottos of the Professional Surveyors of Canada (<http://setyourboundaries.ca>) or the AOLS, which is particularly problematic as far as future sustainability is concerned (“ask me about geomatics”).

In his book, “The Mystery of Capital”, Hernando de Soto recounts his experience walking through the rice fields of Bali. Although there was no clear indication of where property boundaries lay, every time he crossed from one farm to another a different dog barked. Listening to the barking dogs, a reasonable approximation of the property boundaries could be determined. Similarly, surveying associations and institutions need to heed the many barking dogs: their own members, geospatial information scientists, students and the public to mint an expanded profession and relevant and sustaining brand and restore the surveyor to the role of a trusted land advisor. 

Reference:

- Frank, Andrew A. (1995) ‘Surveying education for the future’, *Geomatica*, 49, 3, 273-282
- De Soto, Hernando (2000) ‘The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else’

David Martin Horwood is the President of S.E.A. Graphics Inc. specializing in software products and consulting in the areas of surveying, engineering and architecture. He an O.L.S. and is currently serving on AOLS Council. He is currently the parcel data management expert for Esri Canada, supporting Esri in development and implementation of new core parcel editing capabilities of ArcGIS. dave@seagraphics.ca

Dr. Brent Hall is Director of Education and Research at Esri Canada. He was Dean and Head of the National School of Surveying at the University of Otago, New Zealand from 2007 to 2011, and prior to that Professor and Associate Dean at the University of Waterloo. bhall@esri.ca

President’s Page cont’d from page 2

know this. The contract for the new website was for the behind the scenes infrastructure or functionality. This functionality seems to be really good and there will be a facelift, or depending on how you look at it, major cosmetic surgery to make it look pretty.

So, bottom line, we are much closer to having a new website than we were a few months ago. We had the web developers come to our September 10th Council meeting and we stressed repeatedly that it was critical that the new website be fully functioning and live before the January 1st membership renewals.

The next big thing that will happen on January 1st is the introduction of mandatory continuing professional development. Paul Church and his committee have been working on the details and the reporting forms and will be doing a presentation at the fall regional groups and the October 19th general meeting to update everyone.

There are a number of other committees and task groups that are also extremely busy. The Professional Standards Committee has just formed but they are already full throttle with a full plate of tasks. The Peer Review Task Force is looking at amendments and improvements to the current SRD processes for the inclusion of the expanded profession as well as for cadastral members. The Public Awareness Committee and the Geomatics Recruitment and Liaison Committee are as

busy as always. The Discipline Committee is the only committee I wish wasn’t as busy as it is. As mentioned earlier, the Discipline Committee had to make a call for new members to help form Discipline Panels due to the number of recent referrals. Personally, I find it unfortunate that this is the case but as the Regulator, part of our function is to govern our members to ensure the public interest is served and protected.

Lastly, our legal Lay Councillor, Eric Bundgard’s, appointment is over. His last official Council meeting was on September 10th. Eric’s devotion and service to Council, our members and the public has been invaluable. His calm and reasoned inputs will be greatly missed. Since Eric was bound to us until a replacement was appointed that means we will have an announcement shortly to introduce our newest lay member to Council.

The theme of the President’s Page this time is “engage-ment” of the AOLS members and how that has changed over the last few years. I mentioned earlier about the Strategic Planning and I believe that was a major influence in that change. That being said, there are many parts of our profession that have taken up the torch of change. These include, Council, various Committees and Task Forces and the AOLS staff. I would like to take this opportunity to thank all those involved. 