Geospatial Industry Outlook 2.0, *Opening Panel Remarks at GeoTec 2008*

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(Note: these notes outline J.K. Berry's remarks at the Plenary Opening Panel on Geospatial Technology Outlook for the 2008 GeoTec Conference, Ottawa, Ontario, Canada, June 3-5; click here for .pdf version)

Moderator: **Todd Danielson**, Editor, GeoWorld Magazine

Panelists: **Xavier Lopez**, Director of Spatial Technologies, Oracle Corporation — **David Linen**, President, DSI Consulting — **Kenneth Clay**, Tele Atlas Corporation — **Joseph Berry**, Principal, BASIS and Keck Scholar in the Geosciences, University of Denver

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(Click here for a .pdf version) The following is a synopsis of Dr. Berry's notes/remarks to the questions on Geospatial Industry Outlook—

QUESTIONS EXPECTED TO BE ADDRESSED IN THE FIRST HOUR…

1. The world appears to be settling into an "uncertain" economic climate, with most indicators appearing negative. What kind of impact do you think this will have on the geospatial industry? Will our industry "cool down," or does it have the potential to rise above the uncertainty around it? Also, does the geospatial industry have the ability to help economies recover (i.e., can it be used to limit fuel consumption/prices, can location technologies make businesses more efficient, etc.)?

My maverick vote is that there will be a "cool-down" …maybe even a melt-down for some portions of the Geotechnology industry because new technological advancements tend to be capital investments that compete with operational budgets and involve high $/time/restructuring/training costs before a Return on Investment is achieved. Good economic times fuel these advancements; bad economic times are a wet blanket. The low-hanging fruit of automating existing organizational functions already has been accomplished for most "natural" industries and applications. It is difficult to muster support for implementing new and unfamiliar initiatives in times of uncertainty—"circle the cost control wagons" is the normal reaction.

Could Geotechnology help economies recover? …an emphatic YES BUT only for organizations with capabilities in-place as investment skittishness trumps new initiatives. Most potential savings and possible new revenue streams from technological advancements are viewed with skeptical eyes as uncertain and/or long-term bets. New ways of doing things are easily delayed for better economic times and cash flows.

However, there are "killer apps" exceptions, such as MapQuest in the late 90's and Zillow more recently, that completely change the playing field and how folks gott driving directions and real estate estimates. A "killer app" is hard to keep under wraps but normal re-tooling of existing business processes can't poke its head above a wet blanket economy and a skittish senior management mindset.

2. One of our panelists, David Linden, has proposed that the geospatial industry is now entering its "second generation," as many of the original "players" have retired, and there are many new "players" that really have no idea of the industry's history or roots. Do you agree with this statement? And, if so, does this help or hurt the industry? And where do you see more innovation coming from, the remaining established geospatial companies or the new breed?

The new wave of vendors and practitioners have made Geotechnology "a mile wide and an inch deep" through a very utilitarian view of the technology. The "Technology Adoption Curve" from the popular book *Crossing the Chasm* seems to be at play. *Zealots* and *Innovators* of the 60's and 70's and the *Early Adopter's* of the 80s tended to be GIS'ers first, and applied disciplinarians second—there was an excitement for an emerging technology and comradery among a fairly small set of actors coalescing around an unfolding common vision.

The 90's saw the *Respected Few* and *Deliberate Majority* joint the ranks as GIS became a more mainstream technology. Today in the 2000's, many GIS applications are down to the *Laggards* who reluctantly join out of fear of being left behind—catapulting Geotechnology from the friendly few and mainstream to a mass-market mentality. This tends to "pull" the technology toward what the market thinks it should do instead of leaders "pushing" the technology to what it can do …more direction from the board room than from the research wing. This situation that isn't all bad as it tends to maximize utility and stability, but it does stifle out-of-the-box thinking a bit.

Although our history/roots enriches (and sometimes embellishes) the technology and also keeps us from repeating old errors, new perspectives are what advances it—and in turn becomes new history as the cycle proceeds.

Innovation can come from either the Established or New Breed camps but both need vision and a grasp of new techniques as the catalyst. The Established camp has a good hold on a broad vision (as well as considerable scar tissue experience), but a murky understanding of new techniques can cloud the way to get there. The New Breed has a good hold on new techniques but can lack the holistic perspective that results from years of experience. More importantly, they lack the "power-hitting" position that allows them to steer the ship.

A symbiotic relationship between the Established and New Breed camps is the ideal seedbed for innovation. The technical life span for most individuals is 10-15 years before they get kicked-up to management (or kicked-out on the street). The career path from technician to power-hitter can be about the same duration. If the cycles mesh and are in-phase and collaborative, a killer innovative team is born; if they don't, discord and corporate demise likely await.

3. New 3-D collection hardware and software make 3-D data collection easier and less expensive. 3-D data viewing in Geographic Exploration Systems is fueling some interest, but so too are the parallel interests of architectural design, military planners and online gaming platforms. What are the implications of this development, and what kind of advancements can we expect in how we are able to visualize and interact with our data?

3-D collection hard/software is most often thought of as Lidar digit terrain surfaces …X,Y,Z coordinates in geographic space. This is a very exciting field for its high precision and broad coverage that had to wait for storage, processing and display capabilities to catch up with the sensors. Lidar has been around since the 70's when I was a shave-tail remote sensing student (the Geotechnology pre-Paleolithic period) but had to tread water in the research arena until the operational computing environment grew up.

However, what I think will be the lasting legacy of the laser-focused terrain application (pun intended) is its impact on how we conceptualize mapped data—from discrete map features composed of points, lines and polygons, to continuous map surfaces composed of grid cells.

The paradigm-shift from X,Y discrete to X,Y,Z continuous forms of mapped data sets the stage for tremendous advancements in both capabilities and applications. For example, think of a continuous product sales surface for a city replacing a complex pattern of jigsaw puzzle pieces (polygons) indicating just three discrete levels of sales with the boundaries are defined by subjective thematic ranges (Low, Medium and High). Significantly more information about the spatial variation is retained in the continuous surface through the highly resolved analysis frame to position the data (X,Y) and a continuous range numbers with decimals (Z) instead of just a few broad categories.

This grid-based expression for mapped data with X,Y indicating placement (Where) and Z indicating characteristic (What) is often referred to as 2.5-D; "official" 3-D data requires that all three axes are geographic coordinates. However, if your mind will allow without exploding, imagine the X,Y,Z coordinates defining a continuous set of cubes floating everywhere in geographic space (at, above and below the Earth's surface) to identify position in 3-D geographic space and a fourth value to indicate the characteristic/attribute occurring within each cube …3.5-D space.

Because of the alignment limitations of the squares and cubes used in Cartesian geometry, tomorrow's representation of continuous space likely will use regular hexagon and dodecahedral (12-sided volume) shapes as their geometry "nests" without gaps in representing our curved earth (2D circle; 3D ball). How about we call this new coordinate system "Berry-ball space?" …I am sure Descartes won't mind. What is important is that the 3-D continuous **surface** and **volume** features are a direct extension of the 2-D discrete **point**, **line** and **polygon** features used in traditional mapping. This will be a revolutionary step in the evolution of Geotechnology.

EXTRA QUESTIONS…

4. Spatial data are being created at astounding rates, but is there enough spatial analysis going on? Is the geospatial data being put to good use to provide decision support and business intelligence? Is spatial analysis adequately addressed by today's practitioners to make the most of the time and effort that goes into data creation and data maintenance?

Geotechnology is in its fourth decade—70s Computer Mapping; 80s Spatial Data Mining; 90s Map Analysis and Modeling …and 00s Multimedia Mapping which has our current focus on the Internet and Display (e.g., data portals, Google and Virtual Earths). It seems we have come full circle with the visualization/display emphasis a modern echo of computer mapping's original focus ...70s emphasis but using modern computer expressions.

While never enough (my view), there is a lot of spatial analysis going on …but proportionally there is a lot more basic mapping going on. This mapping for and by the masses has considerable WOW-factor appeal and is capturing most of the attention. Heck, zooming-in on some cool static maps draped on a 3-D terrain surface with a high-resolution satellite image as a backdrop …what's not to like? The technological "pieces" for the feat, however, have been around for years; just not in a comprehensive, universally accessible, easy-to-use, and quite frankly "sexy" package.

Basic mapping has been telling us "Where is What" for thousands of years, but spatial analysis extends geographic inventories to "Why and So What" that supports decision-making by investigating spatial patterns and relationships. For example, you can hang a bunch of maps of crop yield and soil nutrient levels of a farmer's field on the wall (or slam them into Google Earth for that matter) but the farmer hasn't the analytical capacity to translate the "visceral viewing" into an on-the-fly variable rate map that continuously adjusts the application rate of fertilizer throughout a field. Similarly, a retail marketer can't visually translate the detailed patterns and relationships in a bunch of side-by-side sales maps into a targeted bulk mailing. Nor can a pipeline routing team effectively site a pipeline by simply looking at a 3-D terrain display—the visualization leap from maps to spatially directed actions rarely crosses the decision-making chasm; there is just way too much detail and complex patterns/relationships to absorb like a stroll by a Monet painting in the Louver.

There is a huge disconnect between today's practitioners and spatial analysis. We are in our second round of a massive map-down that, like a black hole, is sapping most practitioners' energy …the first round was in the 80s converting paper maps to digital maps. Today, the map-down is converting our spatial data bases from corporate computers to Internet portals.

5. Geospatial data rights is an issue that's receiving much attention lately, particularly with government-created data. Do governmental organizations "own" their data, or should they be considered completely "public access?" Should any government agency be allowed to sell its data at more than the cost of production? Are there any exceptions? Also, should governments be able to "classify" any data that they see fit (for security or other reasons), or are "public data" truly public and shouldn't be withheld?

Governments don't "own" the data; the public that bought and paid for its generation are the owners. However, this doesn't necessarily translate into "free public access" as simply a by-product of the process. If through legislative means (not administrative edit), the "public owners" deem it in the collective best interest to cash-in on the value-added component of commercial use, so be it. However, there is ample evidence that freely distributed data has tremendous social value and can serve as a huge economic stimulus, as well as support sound decisions in the private, public, academic and non-profit sectors. The "small change" generated by sales of the data is hardly worth it, compared to the impediments it poses to national advancement.

Cost recovery, at first glance, seems an equitable compromise pricing of the data. A higher price derives profit that sort flies in the face of a public good and blurs the line between public and private sectors. Pricing mapped data below cost moves it from a cost-accounting perspective to an investment instrument. Governments invest in many arenas from vaccines to bolster public health to national parks to enhance enjoyment and understanding of the natural world. Underwriting mapped data seems an ideal mechanism for advancing the collective good with high returns on investment in both economic and social terms …a "no-brainer" from my perspective and seems to be the U.S. government's position.

Sensitive data, on the other hand, needs to be safe-guarded …the rub is "who" determines what is sensitive. An administrative "data gatekeeper" tends to clamp-down on access, in part, to bolster their important position and minimize hassle. In the "U.S. Litigation Society" the courts are the ultimate arbitrators—sue to get what you want (or don't want) to be distributed. For example, Madonna sued the State of California for releasing high-resolution imagery of the coastline that included her Malibu estate; she lost. However, courts upheld the policy of not releasing economic information at the county level on lama farming if there is only one lama farm in the area …it would be effectively releasing a single individual's books.

EXTRA, EXTRA QUESTIONS IF AUDIENCE DISCUSSION LAGS…

*6. **Geospatial for Infrastructure —** there is increasing pressure on those that create and maintain infrastructure to increase efficiency. The concepts and tools for Building Information Management (BIM) are maturing. Through the work of the Open Geospatial Consortium, standards to enable greater integration between CAD, BIM and GIS are being worked out. What is the future of GIS for infrastructure?*

The cross-fertilization between CAD and GIS has been recognized since the inception of computer drafting and mapping in the 70s. However, the pending marriage is still in the "stilted courtship" phase because of the perceived "near irreconcilable differences" in spatial interpretation and implementation …engineers and geographers rarely cross paths on campus, little alone date and marry. GIS can greatly benefit from the "object-oriented-ness" of CAD; likewise, CAD can

greatly benefit from the "down-to-earth-ness" of GIS. The marriage seems made in heaven, but the legacy mindsets can be worlds apart (read family-feud as in Romeo and Juliet). It just might that the marriage counseling of the greater Information Systems discipline in the form of OGIS might be the needed arbitrator …stay tuned because we ain't quite there yet.

7. ***State of Innovation —*** *Consumer-oriented Web mapping tools seem to add a new functionality every month. This pace is difficult to match on the geospatial platform tool side. What's the current state of geospatial technology innovation, and where are the frontiers with the greatest promise?*

Innovation is rapidly shifting from "flagship" systems and established GIS vendors to 1) large IS firms for commodity applications and 2) to relatively small "developers" providing laser-focused custom solutions for well defined specific industry and individual organization applications ...both are capitalizing on web-based services as the mechanism. An interesting spin to both is a growing set of Open Source solutions that capitalize on the "Wiki-mania" approach to systems development. In this scenario, GIS tools are hung out on the web for free (or relatively low cost) and the cyber-swarm nurtures it. The applications of system can vary from basic mapping to fully-functioning targeted apps that require considerable spatial understanding; these solutions can be freely distributed or commercially restricted.

My advise to the best of the best grad students is that "Solution Developers" will be tomorrow's leaders of Geotechnology. There will always be a place for "GIS Specialists" in nurturing the ever expanding Geotechnology bubble …read job security. However those who translate current needs and future capabilities that the client didn't even know about is at the cutting edge.

8. ***Geospatial Web —*** *Consumer-oriented geospatial Web tools, such as Google Maps and Earth and Microsoft Virtual Earth, have taken the industry by storm over the past year. We see that geospatial capability has become a primary battleground for search. Where will this flurry of activity lead the geospatial technology industry vendors and practitioners?*

GeoExploration tools like Goggle and Virtual Earths primarily are vying for eyeballs. Both are like remora attached to a shark, as they feed off the "advertising clicks" that follow one's virtual tour of the globe. However, VE extends the business model to fully integrate the visualization tool into Microsoft's Office suite. This added boost beyond just eyeball-locking software brings VE closer to GIS-like utility …beyond mapping per se.

While 3-D visualization has captured the world's attention, it's the big-hitters in database technology that will determine Geotechnology's future. As Oracle, Sybase and other DB vendors swallow GIS functionality (and possibly whole GIS vendors) the playing field will most certainly change …but for the better? I am not sure. But for the current array of vendors and practitioners it will be different—that's for certain.

9. ***Legal and Ethical Issues —*** *Jerome Dobson with Kansas University notes that the same geospatial technology that has so many beneficial uses also has the potential to create a highly sophisticated form of "geoslavery," that can be used not only to spy on people but to control them as well. Is this threat real or imagined and will the perception of geoslavery significantly alter the development and implementation of Geotechnology.*

With any technological advancement there comes a potential downside. The threat of "geoslavery" is real but greatly exaggerated and, for the most part, offset by the "cyber-liberation" brought on by shedding the paper map and out-dated magnetic compass. While the thought that "great-honking computers" will know everything that we do, what we buy and where we go affronts our private space psyche and smacks of Orwellian control, the reality is much different. In modern society spying and control occurs without geo-referencing all the time. Your shopping basket is scanned to automatically total the bill, keep inventory, help determine in-store specials and out-of-store marketing. If you use a preferred customer card "they" who you are and, yes, where you live. But that's a far step from a knock on your door and confrontation over purchasing a sleazy brown-bag novel …it hasn't happened yet, and Orwell's book spoke of 1984.