Missouri Surveyor

A Quarterly Publication of the
Missouri Society of Professional Surveyors

Jefferson City, Missouri June 2014

What's in this issue...

MISSOURI SURVEYOR

CALENDAR OF EVENTS

2014-2015

July 18-19, 2014
Board Meeting and Pac Fundraiser Golf Tournament
Minimum Standards Workshop
Capitol Plaza Hotel
Jefferson City, MO

August 20-22, 2014
Review Course
Jefferson City, MO

October 23-25, 2014
57th Annual Meeting and Convention
Joint Meeting with the Kansas Society of Land Surveyors
Sheraton Overland Park Hotel,
Overland Park, KS

December 6, 2014
Board Meeting, MSPS Office
Jefferson City, MO

May 7-9, 2015
Board Meeting and Spring Workshop
Lodge of Four Seasons, Lake Ozark, MO

Donald R. Martin, Editor

Cover Photo: On May 31, in honor of the 250th Birthday of the City of St. Louis, the St. Louis Chapter of the Missouri Society of Professional Surveyors held a Re-enactment of the Founding of St. Louis. In recognition of the semi quincentennial anniversary, volunteers in period costumes performed a re-enactment of laying out and surveying the first three blocks of the village that was to become the City of St. Louis near the South leg of the Arch. Professional Surveyors conducted GPS-guided walking tours on what is now the Arch grounds, locating the sites of which the earliest residences in St. Louis stood. There were also demonstrations of modern surveying techniques, including the use of robotic instruments, laser scanners and terrestrial photogrammetry. *Pictured is surveyor Sarah Francis. The photo was taken during construction of the new Busch Stadium.*

Notes from the Editor's Desk

Donald R. Martin

Welcome to the summer 2014 edition of Missouri Surveyor…and busy summertime. Talk about busy! Those MSPS surveyors have been *at it* all winter and spring; busy with their committees, busy with their legislative affairs, busy with their projects – just plane taking care of business! That's what it takes to look after our venerable profession in Ol' Missouri and our members do a good job of it. I could say they've been busy as beavers but my pard Tripod the three-legged ground hog might feel slighted. He's still a little touchy about my satirical pining on the February excursion outside his purlieu to render weather projections for a prediction of the *post mortem* of winter in our most recent edition past. So as my resident land-beaver looks for the summer cover of shadows other than his own, please partake in your own respite period to peruse this periodical and ponder on the proceedings here in…

Heed the call of our first feature, an announcement for Awards and Board nominations. This is followed by Ken Whithead droning on in *The New Kid in the Sky*. Next Clint Joseph of Australia shares his version of surveyors' universal curse of monument recovery in *Oh the Bane of the Rural Surveyor*. On then to a piece from the Construction Equipment Guide where Dave Moeller identifies the surveyor as the project partner who reins technology into the realm of efficiency in *Iowa Engineer Ponders the Future of Land Surveying*. Then follows a review of *Land Surveying in South Africa* – it is interesting how on another continent, in another hemisphere, they too confront the challenges of surveyor education, records access and needed legislation (sound familiar?). For our June edition which comes during the first month of the Atlantic hurricane season I have included a study from our international federation. *The Contribution of the Surveying Profession to Disaster Risk Management* is an analysis of surveying as a "central pillar" in preparation for and management of risks from disasters.

For those avid readers seeking answers to last edition's challenge from Dick Elgin, the good doctor provides the answer and congratulates the prize-winner. If you didn't get it right the Ol' Professor has a new offering too. From knowledge testing we move to business impact in *Davis-Bacon Misapplied* from the NSPS legislative consultants at John M. Palatiello & Associates. Nick Talbot then heralds the future of positioning with the addition of the BeiDou system in *Advancements in Global Navigation Satellite System (GNSS) Surveying with BeiDou Satellites*. From Missouri's entertainment capital of Branson (what doesn't happen there stays there) comes a news article featuring NSPS's Curt Sumner and the surveying technology of vehicle mounted LiDAR – read Curt's comments in *City Plots Future Using 3D Scans*.

Enjoy this edition and keep up the good work you do. Our great members preserve the integrity of the surveying profession and protect the welfare of the Missouri we serve. This part of MSPS is your newsletter, and our voice of *surveyors leading the way!*

Donald

THE MISSOURI SURVEYOR

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EDITOR

Donald R. Martin
105 S. Capistrano
Jefferson city, MO 65109
Phone (573) 619-8702
E-mail: editor@missourisurveyor.org

PUBLISHER

Sandra Boeckman
P.O. Box 1342
Jefferson City, MO 65102
(573) 635-9446 FAX (573) 635-7823
E-mail: msps@missourisurveyor.org

President's Message

Robert L. Ubben, PLS

I hope everybody in the land surveying industry is having a great start to spring and summer. I know my co-workers are enjoying work much more now after having such a harsh winter. I would imagine that late spring and early summer have always been a favorite for Missouri surveyors.

The MSPS 36th Annual Spring Workshop was held May 8-10 at The Lodge of the Four-Seasons. The Education Committee did a great job in coordinating this event and creating a very interesting workshop. There is a lot of work that committee co-chairs Dan Govero and Susanne Daniel do to put these types of events together and make them available to our members. The education committee is key to our organization and its members. I have a great deal of respect and gratitude for the time and effort they afforded MSPS in this particular event. There was a terrific program of speakers with new topics that were touched on during this weekend event.

The St. Louis Chapter of MSPS has been working on a unique event. In recognition of the 250th anniversary of the founding of St. Louis, Missouri they are planning on spending Saturday, May 31 at the base of the Arch. The purpose is to share some early history of the city with the public, and demonstrate some past and present methods of land surveying. There will be a reenactment of the laying out of the first three blocks of the village that later became the City of St. Louis. This will be a fun event. There is opportunity to help with this event to make it memorable to the public. If you are interested and able to volunteer some time to help the St. Louis Chapter on this day, please contact MSPS for more information.

Once again, MSPS will have a booth at the Missouri State Fair. The fair runs from August 7-17. The booth will be located inside the Agriculture Building and will be staffed from 9:00 am to 9:00 pm all days of the fair. Having enough volunteers to staff the booth is important so we are able to interact with the public in a fun and meaningful way. If you were at the Spring Workshop you probably noticed a sign-up sheet for volunteers to help staff the MSPS booth. The plan is to split the ten days of the fair into two shifts of 6 hours each. Any time you are able to volunteer for the 2014 State Fair would be greatly appreciated. MSPS Executive Director, Sandra Boeckman, is the best person to contact if you're able to help out at this public relations event. I have done it a few times in past years and have always enjoyed my time at the booth.

On May 21 MSPS is doing a half-day strategic planning session. As far as I know, I think this is a first for the association. The purpose is to set priorities for MSPS to focus on over the next five years, and create a plan to implement them. Some tentative topics for the strategic plan are licensure requirements, providing college courses for licensure, attracting people to join the profession, and the mandatory recording act. Once the plan is in place, I'll report on what the final topics were and the focus points to implementing the plan. Being an ongoing plan, this will surely be reported by the future leaders of MSPS too. The topics in this plan won't be things that can change or happen in one year. They will take some time.

As always, I look forward to seeing everyone at the upcoming meetings. I wish all of you a safe and prosperous start to the busy summer months. Thank you for all of your support to the MSPS organization.

Volunteers needed to run for the MSPS Board of Directors three year term.

Must be PLS and current MSPS Member in good standing.

Send email to Sharon Herman, MSPS Nominating Committee Chair
sharonherman@goverolandservices.net

Awards Nomination Form

to be awarded at the Annual Conference
October 11, 2013 at Tan-Tar-A Resort

Person Nominated:_____

Name of Award:_____

On a separate page highlight the reason(s) for your recommendations/nomination.

Mail or fax completed form to the **Missouri Society of Professional Surveyors, PO Box 1324, Jefferson City, MO 65102, Fax: 573-635-7823, no later than September 15, 2013**. If you have questions contact Curtis McAdams, Awards Committee Chair.

AWARDS

Surveyor of the Year Award has been given since 1987. This award is given to a MSPS member who has given freely of his/her time and efforts to the organization and toward the betterment of the surveying profession.

* Must be a Member of MSPS.
* Should enjoy an outstanding reputation for his/her knowledge, integrity and professional competency.

Robert Myers Service Award has been given since 1990. This award is given to an MSPS members who, over an extended period of time (ten years minimum) has given exemplary service and dedication to the surveying profession and in particular to the Society.

PAST RECIPIENTS INCLUDE

Surveyor of the Year – Darrell Pratte, Chris Wickern, Mark Nolte, Ralph Riggs, John Teale, Mike Gray, Don Martin, Dan Lashley, Richard Cox, Jim Mathis, Robert Shotts, Troy Hayes, Craig Ruble, Gerard Harms, John Holleck, John Stevens, Richard Barr, Erwin Gard, Charles Kutz, Robert Myers, Dan Govero, Jim Anderson, Mike Flowers, Bob Pirrie, and Jerry Day

Robert E. Myers Service Award – Troy Hayes, Rich Howard, Stan Emerick, Don Martin, Robert Myers, John Teale, Jim Mathis, Robert S. Shotts, Stan French, Dan Lashley, Gaylon Smith, Gerard Harms, John A. Holleck, J. Michael Flowers, Erwin Gard, Rich Norvell, David Krehbiel, Richard Elgin, Dan Govero, Jim Anderson, Rich Barr, Norman Brown, and Harold Schulte

YOUNG SURVEYORS/ASSOCIATE MEMBERS

We are having our first meeting for Young Surveyors/Associate Members of KSLS and MSPS. This group is for non-licensed and newly licensed (under 5 years) surveyors. With this first meeting we will be doing a meet and greet to establish what you would like to get out of this group. Some ideas for the group would be a mentoring program, 3 hours Minimum Standards (instead of 2 hours) class so you can ask questions, bring in some speakers pertaining to 401K's, life insurance, etc. We are just getting this program started so it would be a great time to get involved. If you have any questions please feel free to call Valeri from KSLS at 316-680-5159.

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New Kid in the Sky

by Ken Whitehead, MSc

Lightweight unmanned aerial vehicles show their worth on small-scale photogrammetric projects and offer advantages over traditional aerial mapping and ground surveying. A Canadian company shows how.

Based in Salmon Arm, British Columbia with offices in Alberta and Ontario, Accuas specializes in using lightweight unmanned aerial vehicles (UAV) to perform photogrammetric surveys of small sites. Since the company's inception three years ago, it has flown a wide variety of jobs for a diverse range of clients, including consulting engineers, environmental consultants, and aggregate companies as well as local and provincial governments. The company has enjoyed success with this relatively new form of aerial mapping.

The Outlander in action in the Canadian Artic

For sites of 10 km2 (4 square miles) or less, UAV surveys represent a cost-effective alternative to traditional photogrammetric data collection methods. The ability to fly small areas at a relatively low cost allows aerial photogrammetry to be applied to many tasks traditionally performed by land surveyors, such as cut-and-fill analysis and volumetric survey. A typical UAV survey uses low-cost consumer-grade cameras for data collection. High spatial resolutions of around 5 cm are possible because typical flying heights are less than 300 m (1,000 feet), about a tenth the height of most manned photo collection missions.

Over the last few years, lightweight UAVs weighing less than 4 kg (10 pounds) have been developed. These are similar to radio-control (RC) hobby aircraft but are typically designed to carry small payloads and operate semi-autonomously. Unlike the large UAVs used by the military, these platforms stay airborne typically for an hour or less and carry lightweight sensors such as digital cameras or thermal video cameras.

UAVs differ from RC hobby aircraft in a few other ways. The aircraft follows a pre-programmed flight path, which is uploaded to an on-board auto-pilot. The flight plan guides the aircraft to a series of waypoints and determines when photographs are to be taken. Normally, the aircraft flight is remotely monitored on a laptop computer with the operator typically taking control only on takeoff and landing.

Accuas currently uses several Outlander UAVs developed by Manitoba-based CropCam. This aircraft weighs around 2.7 kg (six pounds), with a 2.5-m (eight-foot) wingspan. It is capable of flying for about 45 minutes on a fully charged set of batteries. The aircraft carries a maximum payload of .4 kg (one pound), which necessitates using a compact camera for imaging. While these cameras are lightweight, the small sensor size and the fact that the lens is not fixed mean they have relatively poor image geometry and must be frequently recalibrated to achieve optimal results in the photogrammetric process. In addition to standard photogrammetric applications, the company also uses a custom-built near-infrared camera for carrying out projects relating to vegetation health. The information provided by this camera is useful for applications such as precision agriculture and monitoring drought stress. In the future it may be possible to incorporate additional sensors such as a miniature lidar for applications in densely forested areas.

In addition to the low cost and relatively high spatial resolution, UAV surveys offer a number of other advantages. Due to the low flight ceiling, photographs can be obtained under overcast conditions and at relatively short notice. This makes it possible to obtain shadow-free imagery, which can be useful for mapping in forested and urban areas where strong shadows can obscure surface detail.

Other advantages include the fact that UAVs can be easily mobilized for frequent repeat surveys of rapidly changing areas. UAVs can also be applied where safety is a concern, such as when monitoring forest fires or overflying volcanic regions. In these cases a UAV survey may be carried out without risking the lives of flight crew members.

Despite these advantages, UAV-based photogrammetry has been relatively slow to catch on in North America. Numerous reasons exist for this, but the main stumbling

block is the present regulatory environment. It is particularly at issue in the United States where current Federal Aviation Authority (FAA) rules make civilian use of UAVs almost impossible. This situation may change over the next two to three years, as the FAA is currently drafting preliminary rules governing UAV use in U.S. airspace.

In Canada, the picture is somewhat brighter. Under Transport Canada regulations, individual provinces may issue a Special Flight Operation Certificate (SFOC) that permits the operator to carry out a UAV survey provided the aircraft remains in sight at all times. In both jurisdictions, there is a move to integrate UAVs into civilian airspace, although it is likely that full integration will occur only with the development of reliable collision-avoidance systems.

Evolved Field Procedures

Setting up to fly an aggregate site in western Canada

While there is no such thing as a typical job, most projects tend to follow a series of similar steps. On arrival at the site, one of the crew members will place targets every 200-300 m across the site. These targets are surveyed using real-time kinematic (RTK) GPS to give an accurate framework of ground control points (GCP). While the survey is being performed, the other member of the field crew plans the flight using in-house Accuas Mission Planner software. With this package, the operator can set the flying height, photo overlap and strip overlap, and the strip orientation. By carrying out flight planning in the field, it is possible to account for unforeseen conditions such as high winds.

Once the flight plan is complete, it is uploaded to the aircraft. After preflight checks, the aircraft is launched by hand, and it will then fly the path created in the flight plan. On completion of the survey, the aircraft returns to the takeoff point, at which time the operator takes control and flies it into a net. The log file of the flight and the photos are then immediately downloaded to a laptop computer.

Once the data acquisition phase is complete, the job can then be processed. Accuas uses Trimble's Inpho software for photogrammetric processing. This is a high-end photogrammetric package that can be adapted for UAV surveys. On average, a UAV survey will generate between 100 and 500 photos. Typically, half of these are redundant because surveys are usually flown with a 60% overlap between strips in addition to the standard 60% overlap between photos. Usually this means that every second strip can be omitted from a project. The high overlap is useful in windy conditions, when a lightweight aircraft can be blown off course, and in hilly terrain. Where relief variations are high, the low flying height can potentially lead to large-scale variations between photos as well as gaps in stereo coverage. Under such conditions, the additional strips can be used to fill in gaps in the data.

Once the project has been set up, triangulation and block adjustment are carried out to establish the full set of orientation parameters for each photo. At this stage, many manual tie points are still required as initial input to the triangulation process. Using the measured position of GCPs, as well as manual tie points and initial estimates of the camera orientation parameters from the log file, a series of automated tie points is generated. These points allow accurate values to be calculated for camera orientations using a rigorous bundle block adjustment procedure. A good triangulation is a necessary first step to get accurate elevation models and orthophotos. In the future, improvements in the quality of camera orientation measurements recorded in the log file are expected to reduce the need for manual tie points.

Following triangulation, a digital terrain model (DTM) is normally generated for the job. DTMs generally have a smoothing effect, with buildings and small clusters of trees being filtered out. In general, a DTM will produce a smoother-looking orthophoto than a true surface model (DSM), which will often have a choppy appearance where there are sudden and abrupt changes in height. Orthophotos are generated from each photo using the DTM, and the individual orthophotos are then combined to produce an orthophoto mosaic, typically with a resolution of between 5 and 10 cm.

For volumetric surveys, a full surface model is usually generated. This is more time consuming, but the surface representation is usually more accurate than can be achieved using a DTM. Areas of interest such as individual stockpiles are identified, and the surface model is manually edited within these areas to remove unwanted features such as conveyors and buildings. The areas of interest and the edited surface model can then be exported, and volumes can be generated using 3D modelling software.

(continued on next page)

New Kid in the Sky *(continued)*

Several jobs have included independent check points to verify horizontal and vertical accuracies. In such cases, the number of surveyed points is increased, and half the points are converted to check points. Accuracies obviously vary depending on local conditions, but for most jobs, root-mean-square (RMS) accuracies are better than 15 cm in X and Y and 20 cm in Z, which means that 50-cm contours can be produced at better than 95% reliability across the entire jobsite. Relative accuracies for volumetric surveys are considerably higher (for example, when calculating stockpile volumes).

Many Applications

Accuas has completed a variety of projects for different clients. One application for which UAV surveys have proved particularly cost effective is in surveying aggregate pits. Last summer, the company carried out a series of photo surveys for a large aggregate company based in Western Canada. The largest of these jobs covered 4 km2 (roughly 1.5 square miles), and a total of 439 photos were obtained, 200 of which were used in the analysis. The photos were acquired in three separate flights because battery life was insufficient to cover the whole area in a single flight. For this job, 42 GCPs were surveyed, of which half were used as check points.

Figure 1: Stockpiles modeled in ArcGIS

Processing of this job took approximately one day. Following triangulation, a 10-cm orthophoto was generated covering the entire site. A full DTM and DSM were created and stockpile boundaries demarcated using Inpho. The DSM within the stockpile boundaries was then edited to remove spurious contours generated by conveyors and other machinery. As a final step, the stockpile boundaries and digital surface model were exported, with final pile volumes being calculated using custom developed tools in ESRI's ArcGIS software (**figure 1**).

UAVs may also offer an ideal way to carry out surveys in remote areas. Last July, I used an Outlander UAV provided by Accuas to carry out unrelated fieldwork in the Canadian Arctic. The objective was to map the terminus region of Fountain Glacier on Bylot Island, which lies at 72° 58' North, 78° 23' West. In this case, the major challenge was flight planning. To acquire imagery with the required 10-cm resolution, it was necessary to fly at 300 m above the glacier surface. However, Fountain Glacier is surrounded by high mountains, so any miscalculations could have resulted in losing the aircraft.

Another problem was that the surface elevation of the glacier varied by 180 m over the terminus region. This variation represented more than half the flying height and would have resulted in major scale variations as well as the probable loss of stereo coverage over the high areas closest to the camera. The solution adopted was to orient the flight lines crosswise over the glacier, with the aircraft dropping by 12 m (40 feet) at the end of each flight line. By following this approach, it was possible to fly the terminus region of the glacier in 15 strips while keeping scale variations to a minimum. In total, 148 photos were gathered, and these were processed using Inpho to produce a detailed 1-m surface model of the glacier as well as a highly detailed 10-cm orthophoto. This level of detail is unprecedented in glaciological studies and opens numerous new research possibilities.

Figure 2: Complete mosaic of the Adams River in British-Columbia documenting the sockeye salmon run—the inset is at full resolution, with each dot representing a spawning salmon.

The company has completed a wide variety of other jobs, including monitoring landfills, slope surveys for highway applications, and studies of vineyard health using false color infrared imagery. One of the more unusual applications was to fly the Adams River salmon run in October 2010. Every four years sees a major return of sockeye salmon to the river in southern British Columbia. The 2010 run was the largest in 100 years, with an estimated six million salmon returning to the river over a one-month period. **Figure 2** shows the mosaic generated from this overflight. The salmon can be seen as dark reddish lines along either side of the river (the inset shows this image at full resolution). The large reddish areas are groups of thousands of salmon waiting their turn to spawn. The individual spawning salmon may be seen as regularly spaced dots adjacent to the large clusters. This illustrates the resolution that can be routinely achieved using a low-flying UAV.

UAV surveys offer a viable alternative for mapping areas too small for traditional aerial photogrammetry to be cost effective. The use of UAVs can therefore extend the photogrammetric process into applications that have traditionally relied on ground data collection. The ability to gather and process data rapidly in a variety of weather conditions and the dense point grids that can be collected during such surveys make UAVs particularly useful for applications involving repeat volumetric surveys. The high spatial resolution and relatively low cost also creates a range of potential new applications for repeat monitoring and research support. While regulatory hurdles are currently slowing the growth of civilian UAV applications in North America, it appears likely that this sector will become increasingly important over the next few years as UAVs are integrated into civilian airspace.

Through a new strategic partnership, Accuas will be rolling out the next generation of Unmanned Aerial Surveying (UAS) UAVs in 2011 and seeking serious worldwide franchisees/operators. For more information contact Accuas at info@accuas.ca.

Ken Whitehead, MSc, is a specialist in photogrammetry/ remote sensing at Accuas, a company using unmanned aerial system technology for data acquisition services and geospatial solutions in British Columbia, Canada.

MO Colleges/Universities Where Land Surveying Coursework is Available

The following list will be updated quarterly as new information becomes available.

Longview Community College — Lee's Summit, Missouri
Contact: David Gann, PLS, Program Coordinator/Instructor — Land Surveying MCC — Longview, MEP Division
Longview Community College
Science and Technology Bldg.
500 SW Longview Road
Lee's Summit, Missouri 64081-2105
816-672-2336; Fax 816-672-2034; Cell 816-803-9179

Florissant Valley Community College — St. Louis, Missouri
Contact: Richard Unger
Florissant Valley Community College
3400 Pershall Road
St. Louis, Missouri 63135
314-513-4319

Missouri State University — Springfield, Missouri
Contact: Thomas G. Plymate
Southwest Missouri State University
901 So. National
Springfield, Missouri 65804-0089
417-836-5800

Mineral Area College — Flat River, Missouri
Contact: Jim Hrouda
Mineral Area College
P.O. Box 1000
Park Hills, Missouri 63601
573-431-4593, ext. 309

Missouri Western State University — St. Joseph, Missouri
Contact: Department of Engineering Technology
Missouri Western State University
Wilson Hall 193
4525 Downs Drive
St. Joseph, MO 64507
816-271-5820
www.missouriwestern.edu/EngTech/

St. Louis Community College at Florissant Valley
Contact: Norman R. Brown
St. Louis Community College at Florissant Valley
3400 Pershall Road
St. Louis, Missouri 63135-1499
314-595-4306

Three Rivers Communitiy College — Poplar Bluff, Missouri
Contact: Larry Kimbrow, Associate Dean
Ron Rains, Faculty
Three Rivers Community College
2080 Three Rivers Blvd.
Poplar Bluff, Missouri 63901
573-840-9689 or -9683
877-TRY-TRCC (toll free)

Missouri University of Science and Technology — Rolla, Missouri
Contact: Dr. Richard L. Elgin, PLS, PE
Adjunct Professor
Department of Civil Engineering
1401 North Pine Street
211 Butler-Carlton Hall
Rolla, Missouri 65409-0030
573-364-6362
elgin@mst.edu

University of Missouri-Columbia, Missouri
Contact: Lois Tolson
University of Missouri-Columbia
W1025 Engineering Bldg. East
Columbia, Missouri 65211
573-882-4377

Missouri Southern State College — Joplin, Missouri
Contact: Dr. Tia Strait
School of Technology
3950 E. Newman Rd.
Joplin, MO 64801-1595
1-800-606-MSSC or 1-417-782-MSSC

Oh, the Bane of the Rural Surveyor

by Clint Joseph, Surveyor, Victoria, Australia

Oh, the bane of the rural surveyor. No amount of searching, planning or wishful thinking can prepare you for that missing or destroyed Permanent Survey Mark (PSM). I speak of the elusive PSM as opposed to the easily detected iron pipe, rod or star picket with a modern, directional ferrite metal detector – a mandatory piece of equipment in the arsenal of the modern rural surveyor. I, like my predecessors, have undertaken my fair share of unwavering excavations resulting in something between a foxhole and a bomb shelter in a desperate bid to find the ever elusive PSM. Whether the survey mark is from a prior subdivision or an original application survey the frustration is the same and often leads to further exasperation from having to backfill the crater you have just created that rivals Wolf Creek. Excavation works are often bitterly halted after the remnants of broken concrete rubble are discovered. The culprit of such unwanted destruction is often attributed to the placement of underground services such as telecommunications, council drainage / road works or the aggrieved local farmer who has just destroyed the slasher blades on his mower after taking out not only the PSM, but also the marker post that was set in concrete. As an aside, one of the most valuable sources of information on the location and status of the PSM is often the local farmer for he or another unnamed assailant has already undertaken the unthinkable and destroyed a set of mower blades (and the PSM) and is acutely aware of the remaining PSM's locations that are avoided like the plague.

From a project management point of view the result of the destroyed PSM is the same - whether it be for a cadastral survey that now requires additional survey work to the next intersection or crown section together with additional computations, or a level or coordinated mark set out by survey for flood study or a gas exploration drill rig (respectively) and that is time (not to mention angst) - a very difficult variable to factor into any fee proposal or project budget without an extensive, pre-survey reconnaissance expedition.

Reminiscent of a job not long past, a large scale, liner asset mapping project undertaken with GNSS that was required to be connected to locally co-coordinated MGA and AHD marks. Very late one particular Friday after having located the required assets over a five day period our last remaining task was to tie the end of the survey onto a known co-ordinated mark. Armed with an extensive Survey Mark Enquiry Service (SMES) search, several kilometres of back roads were navigated (not to mention the archaeological studies undertaken at several intersections along the way) until a collective sigh of relief resonated from inside the vehicle – we had just sighted the silhouette of a triangle on the fence line just inside the road intersection. Not just a random piece of tin placed on the fence for target practice by the local boys, but a distinct, freshly painted blue triangle marker plate recently placed specifically for and by the surveying fraternity.

Following previous discussion at a regional Glenelg Grampians Group (GGG) dinner it was decided as a collective to assist the Office of Surveyor General Victoria (OSGV) in preserving the local PSM's. When a missing marker plate or post was discovered we would simply place a new marker plate on the adjoining fence. The purpose of this was twofold:

1) We would identify the position of the PSM's that were still present in a bid to help ourselves and;
2) Identify the presence of the PSM's to the public in an attempt to both protect the marks and, as a by-product, promote profession.

The process is inexpensive and in our instance had worked. We have saved / prolonged the useful life of several PSM's recently along routes of major road upgrades with construction crews further highlighting the marks before construction. The triangles are easily transported within our vehicles in a small, inexpensive aluminium case with a pair of pliers and a roll of tie wire and netting crimps. Each triangle takes as little five minutes to place, be it nailed or tied to the fence. The GGG picked up a bulk delivery of triangles by way of a round trip past the OSGV's geodetic section depot, but with a little organisation the triangles could be dropped off annually to the companies that host the EDM baselines in each regional area for pickup.

Thank you to Dr Roger Fraser, Manager, Geodetic Survey Office of Surveyor-General Victoria for his assistance and supply of our 'blue triangles'.

Griner and Schmitz Marks 104 Years in Business

Company Celebrates by Putting Surveyor's Needs First, Like Always

KANSAS CITY, MO—JUNE 2, 2014. No one knows the exact date Griner and Schmitz, Inc., originally called Oswald Griner Co., opened in 1910. However, the date doesn't carry as much significance as the fact that the company survived the Great Depression and supplied troops with instruments throughout two World Wars.

This 104th anniversary celebration is not about tooting the company horn about growth. Griner and Schmitz started as and remains a small company, employing a handful of employees who are dedicated to getting surveyors the equipment they need to keep working. It is not about selling the latest and greatest technology. Griner and Schmitz does not sell any and all equipment, just what is proven in the field. This anniversary is about celebrating the longevity and success that comes when you balance technology with good, old-fashioned customer service.

Today, there are a lot of companies that can sell surveying equipment, pull it off a shelf and ship it. But only Griner and Schmitz can explain how it works and if it is exactly what is really needed in the first place. Their team knows what really matters out in the field and they'll make sure their customers have it. Griner and Schmitz offers training on the equipment they sell, rent or service. There's no company better to trust with surveying equipment than one that has been selling, servicing and repairing it for over a hundred years.

Griner and Schmitz does not have an automated phone system, preferring to answer calls personally. The knowledgeable team is always ready to answer questions—intelligently, no guessing or returning calls a week later.

Jim Martin, General Manager, shares the company philosophy, "We keep our business very personal. Everything we do and sell is taken personally. The sales team works the same way. It's never someone else's fault if something doesn't work right; it's ours. There is no finger pointing here. Just a collective effort to make it right."

By choice, Griner and Schmitz doesn't carry all surveying equipment and GPS technology under the sun. Only the brands like Topcon, Sokkia and Carlson that are proven and built to last.

No one can afford to lose a day or risk delaying the construction schedule, which is why so many depend on Griner and Schmitz. Factory-trained service technicians and knowledgeable staff keep surveyors working. "Equipment glitches, questionable data or total failure, we get back to you in minutes, not hours because time is of the essence. We go to bat for you with manufacturers. We never shrug our shoulders, leaving you high and dry," states Martin.

New technology and old-time customer service go hand in hand at Griner and Schmitz, one of the region's most respected surveying and GPS equipment companies. They've seen their share of surveying technology trends come and go. Customers rely on them for the pros and cons, so they can make well-informed decisions and invest in the equipment that will last for years to come.

Their experience with surveying tools and technology dates back as far as some monuments do, and that's what makes Griner and Schmitz the "monument" company surveyors return to again and again for equipment sales and service.

Griner and Schmitz's last move was in 1952, and the company will soon relocate to a new building at 1700 Cherry Street near its current location. The new space features 13,000 sq. ft., ample off-street parking and an advanced training center.

About Griner and Schmitz, Inc.

Griner and Schmitz, Inc. has been serving the Midwest's surveying, construction, and engineering industries for over 100 years. The company has a full in-house service center, a rental division with products from Topcon and Sokkia, an award-winning sales department, a training department, wireless GPS systems and a data prep department for complete solutions from field to finish.

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Kansas City, MO 64108
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Iowa Engineer Ponders the Future of Land Surveying

by Lori Lovely, ConstructionEquipmentGuide.com

…Using GPS technology, "coordinates can be pulled from anywhere," said [Dave] Moeller*. "It's supposed to be simpler, quicker. Using coordinates uploaded from the electronic design file, a survey crew could set a single piling or light pole with the very first stake set on a project. As unlikely as that example sounds, the information is available, and in an effort to take advantage of opportunities, it is often desirable to have stakes set out of traditional sequence. This new technology has resulted in higher expectations.

"However, as tempting as this is, the stake-out of a project is the first view of the design at full size, or 'one scale,' and is the last chance to clarify the intent of the design shown on the plans. Establishing project elements out of sequence increases the risk of potential conflicts between critical inter-relationships.

Staking is the point of convergence where technology and the digital model meet reality.

"For example, in the installation of a water main before an elevation-sensitive sewer: If there is a conflict, choices are limited, and would likely result in removal and reinstallation of the water main, regardless of plan error or unknown condition.

"What compounds the problem is the accumulation of error. Every thing that is built includes a series of processes: cutting to grade, compacting, installing sub-base material, compacting some more, trimming, paving … All are processes with inherent variability, acceptable within certain tolerances that may compound or offset, depending on the particular application."

Although GPS systems have increased the speed of surveying, they are accurate only to approximately 20 mm. For that reason, EDMDs are still used. Some in the industry believe that's wise, because the "old rules" don't apply in a GPS-driven (vs. coordinate-driven) situation. There is still value in the old methodology that relies on cumulative and individual measurements because it's possible to lose relativity using a coordinate-driven method.

"The reality of construction is that it is a human endeavor, and that real-time adjustments are often made to expedite the work," Moeller continued. "The built environment is a system with various functions where the proximal relationships are more important than the absolute and precise position.

"For example, it is critical that a guardrail is a set distance above the road surface and offset from the pavement lane; the rail's elevation above sea-level or its distance from the moon is irrelevant. Unfortunately, it's much faster to precisely stake the coordinates and elevation of each guardrail post uploaded from a digital file than it is to measure an offset and elevation from the edge of the traveled way. Equally unfortunately, they could both be wrong."

Satellite coordinates may be staked precisely, but it's possible they aren't staked accurately. Precision and accuracy are not the same. Precision relates to the quality of method used to obtain a result; accuracy relates to the quality of the result, the degree of conformity with a standard. The question is, will the new technology and methodology produce the same level of accuracy previously achieved?

Moeller concluded that, by default, the role of the stake-out crew is now the arbiter in the on-the-ground conflict between absolute and relative dimensions. If that is the new role, they will need to be armed with:

- ***different contract language in their relationship with the builder;***
- ***more training in the complete understanding of the entire proposed project;***
- ***more information from the design plans than just coordinate files;***
- ***a close relationship between the designer and the builder (and possibly a three party agreement).***

The debate on the horizon centers on the question of when technology has gone beyond the realm of efficiency.

Using a coordinate-driven system, is relativity lost and are cumulative measurements meaningless?

Measurement is an abstract science. It's inexact; the magnitude of that inexactness is called error — as opposed to a mistake in the application of a measurement, a misreading of the scale or improper adjustment of the instrument. Error is inherent in measurement.

New technology, such as GPS, introduces potential for a different kind of error.

(continued on page 31)

Land Surveying in South Africa

Maintaining the highest standards of professional conduct and integrity

by Simphiwe Ntozini, Reprinted from *Right of Way*, March/April 2013

When the Dutch East India Company established itself at the Cape of Good Hope in 1652, the company assigned land without having it surveyed. As more people settled, the process became more systematic and a land registry based on a Netherland's model was established. Every title deed of a grant of land was accompanied by a diagram showing its boundaries and area. Since many of these areas were circular in nature, the radius was obtained by walking roughly 2.5 miles. The grant of land was not fixed by the survey, but rather a recognizable natural object, if obtainable. This system gave rise to much abuse, and it was abolished by a proclamation that made it mandatory to use surveying and framing of diagrams.

The first geodetic survey was done in 1752. In 1919, Dr. van der Sterr, was appointed director of the newly created Directorate of Trigonometrical Surveys, now known as National Geo-spatial Information, situated at Mowbray in Cape Town. In Van der Sterr's era, the interprovincial rivalry was eliminated, and the country gained the services of a surveyor and scientists whose knowledge and expertise was well ahead of his local colleagues. He became an advocate for introducing the first university degree course in land surveying at the University of Cape Town.

GOVERNMENT-MANDATED STRUCTURE

The Land Survey Act requires the records of all surveys relating to property boundaries to be filed in the Surveyor-General's Office, which is responsible for Cadastral Surveying and Land Information Services in South Africa. These records show how a survey was performed and comprise a field book detailing how the observations were made, as well as a plan showing the relative positions of and survey stations and its coordinates. Surveyor Generals' offices have a safe where they keep all cadastral surveys that have been submitted to them by different land surveyors. These records are used for relocations and all other cadastral surveys to ensure there is no potential for properties to overlap and to avoid conflicting claims to ownership. In each of the nine Surveyor Generals' offices, there are deeds offices that deal with the registration of properties or land. According to the Deeds Registration Act, no portion of any piece of land shall be transferred or registered without a diagram.

TRANSFORMING THE PROFESSION

Today, South Africa prides itself with seven higher education institutions for which survey professionals can be trained. Surveyors are regulated in terms of the Professional and Technical Surveyors Act No. 40 of 1984

(continued on next page)

Land Surveying in South Africa *(continued)*

Figure 1: **Categories of Registration**

Fields of Specialization	Professional	Technologist	Technician	In-Training Professional	In-Training Technician
LAND-CADASTRAL – – – – – – – – – – ENGINEERING	4-year Degree Bachelor of Technology Relevant experience and board exam	National Diploma – Relevant experience and board exam	National Diploma and board exam	4-year Degree	No qualifications; student
GIS PHOTOGRAMETRY	Bachelor of Technology Relevant experience and board exam	National Diploma – Relevant experience and board exam	National Diploma and board exam		
MINING	Bachelor of Technology Relevant experience and board exam	National Diploma – Relevant experience and board exam	National Diploma and board exam		
HYDROGRAPHIC	4-year Degree Relevant experience and board exam	National Diploma – Relevant experience and board exam	National Diploma and board exam		

(referred to as PLATO). As a government-mandated structure, PLATO has four broad categories of registration, as indicated in Figure 1 above.

Each registration category has certain sub-specialisations, such as Land Surveying, Engineering Surveying and Geographic information system (GIS). Technicians and other staff in training are only permitted to work under the control and direction of a Professional Surveyor or a Survey Technologist. By law, when dealing with matters relating to property boundaries or property attributes only a Professional Land Surveyor can advise on or undertake such work.

Contrary to the provision of the law wherein only matters relating to property boundaries are protected, other important infrastructural developments are not wholly protected by the law. For example, the topographical surveys, including precise surveys for roads, power lines and railways, are not legally protected. It is the client's responsibility to determine whether the person is registered with PLATO when appointing a surveyor to undertake a task.

Utilities such as Eskom, road agencies and water affairs bodies take consolation in the fact that the infrastructure will be surveyed at a later stage as an "as built," that is, after construction for registration at the deeds office. The Government's Statutory Survey Council – PLATO does not have legal recourse to unregistered surveyors who either have little or no academic training in surveying, or for those who, for one reason or another choose not to register.

As a solution to this situation, the Minister of Rural Development and Land Reform has proposed the Geomatics Profession Bill.

The main purpose of the Bill is to provide for the:

- Transformation of the geomatics profession
- Establishment of the South African Geomatics Council as a juristic person
- Facilitation of accessibility to the geomatics profession

The Bill also seeks to provide for measures designed to protect the public from unethical geomatics practices and to provide for measures in order to maintain a high standard of professional conduct and integrity. The Bill, when enacted, will repeal the current Professional and Technical Sureyors' Act, 1984.

Simphiwe is a Senior Acquisition Advisor in Land Development for ESKOM Group Capital in South Africa. He has a National Diploma Surveying from Natal Technikon and Bachelor of Technology Surveying from Tshwane University of Technology in Pretoria. He is currently working on his Masters in Project Management with DaVinci Institute South Africa. Simphiwe is a registered Professional Surveyor with South African Council for Professional and Technical Surveyors. He is a member of South African Right of Way Association (SARWA) and IRWA Chapter 83.

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The Contribution of the Surveying Profession to Disaster Risk Management (Chapter 3 excerption from full report acknowledged at end)

3. The Need of the Surveying Profession in Dealing with Disasters

For thousands of years they measure,
divide the earth, draw maps
– surveyors and cartographers.
Prof. **Z. Adamczewski**, Warsaw

3.1 Introduction

The modern surveyor can play an important role in the field of disaster risk management, although in most cases, the activities will take place as part of multi-disciplinary task forces.

About 80 % of daily decisions on national or local level, either in economy, finances / taxation, demography, spatial planning, environment, hazard areas, infrastructure, housing, cultural heritage, etc. **are spatially or geo-referenced**. That demonstrates clearly, surveying is a central pillar of each country and its economy (Magel 2005). Roberge has a more sceptical view of the situations in which surveyors get involved concerning disaster risk management: "Our contribution is neither spectacular nor glamorous. We are not under the spotlight like rescue teams, policemen, doctors, etc. Nevertheless, our role is no less important but merely, too often, unknown or misunderstood" (Roberge 2005).

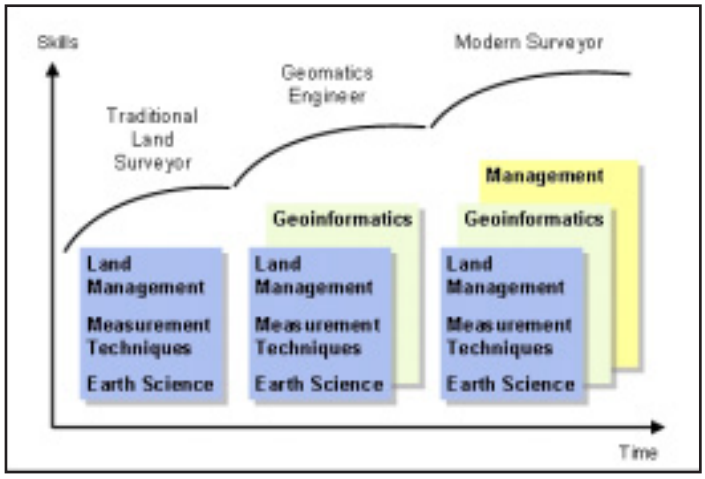

Figure 4: The change of geodetic activities from traditional tasks to new methods (modified, according to Schulte 2005)

As visualized in figure 4, there is an irreversible **process of professional change** in surveying methods and applications in the past decades. Whereas the surveyor in former times (only) had profound knowledge in areas of work such as Earth sciences, measurement techniques and land management, the modern surveyor needs also skills in (geo-) informatics and management. Requirements are not only engineering know-how but also knowledge in business administration (planning, organizing, leading, co-ordinating and controlling) as well as the development and management of databases of geo-data. The modern surveying engineer assists in acquiring, managing, visualizing and analyzing geospatial data related to disasters. Combined with new technologies and methods, the challenging profession delivers the basic principles for disaster risk management within the disciplines geodetic engineering, satellite-based positioning, photogrammetry, remote sensing, geoinformatics and land management (fig. 5).

Figure 5: The need of surveying methods and applications for disaster risk management

However, the five geodetic disciplines listed in figure 5 have to be seen in close interrelationship. The key for success lies in the collaboration and networking between the different disciplines and techniques, e.g. because of the fact that geographic information systems use airborne and satellite data as well as radar and (multi-spectral) images. Of course, as already mentioned, not only the surveyor can contribute to the prevention and mitigation of disasters. The multi-sectoral and interdisciplinary approach to disaster reduction requires interaction, co-operation and partnerships among all related stakeholders and institutions (i.e. local authorities, civil society and private sector).

The following chapters want to enumerate the geodetic contribution in the field of disaster risk management. They will show us that, due to the versatility of our profession, the tasks of a surveyor can be seen primarily in four groups of objects:

I. **Acquisition of disaster-relevant data** by using different data sources such as airborne and satellite data; radar and (multi-spectral) images
II. **Hazard assessment** and design of **monitoring** and/or **early warning systems** as part of **Geographic Information Systems (GIS)** and other computer-based information systems
III. Development and implementation of **preventive measures of land use planning and land management** to reduce disaster damage
IV. **Cadastral reconstruction** using **Global Positioning Systems (GPS/GLONASS)** and/or **Tacheometry** in the post-disaster phase

Especially tools to monitor the risk evolution process are very important. Disaster reduction measures should be based on continuous assessment of vulnerability and hazards, including a vulnerability/hazard analysis and monitoring. Photogrammetry, for instance, is an efficient tool in the monitoring of spatial objects like volcanoes or mass movements with respect to location form and size (Altan 2005, p. 311). The surveyor as an expert in geoinformatics can support the first steps of the disaster risk management cycle, establishing geographic information systems for risk analysis, monitoring and early warning systems. Besides that, virtual 3D city models can provide important information in case of severe destruction of infrastructure to facilitate localization in indoor and outdoor navigation (Kolbe, Gröger, Plümer 2005).

Furthermore, land use and urban planning can help to mitigate disasters and reduce risks by avoiding construction of settlements and key facilities in hazard prone areas, control of population density and expansion.

In the post-disaster phase surveyors' contribution of cadastral reconstruction to the redevelopment of the affected areas is needed. Haroen/Achmad/Rusmawar explain the new cadastral approaches after the tsunami and earthquake in Aceh (Haroen et al 2005). A surveyor as an urban planner can contribute to the rehabilitation of housing, infrastructure and public facilities and to reduce the future vulnerabilities of human settlements.

3.2 Geodetic Engineering and Satellite-Based Positioning

Monitoring and Early Warning using Geodetic Measurement Techniques and Satellite Based Positioning

The main focus of disaster risk management is often dedicated to monitoring of objects, areas, regions or even the whole earth with the aim to give warning to the people that may be affected by a disaster at right time. In general we talk about early warning systems. Early-warning-systems are essential for almost all natural and human-made disasters as mentioned in chapter 1.1. Exemplary catastrophes that are monitored and forecasted by geodetic means are mentioned in the following: earthquake, volcanic eruption, landslide, tsunami, dam or bridge failures.

Obviously to build up early warning system one requires highly interdisciplinary teams: different scientists and engineers have to work together. If one is talking e.g. about tsunamis one needs geologists, geophysicists, hydrologists; to avoid bridge failures the knowledge of civil engineers is non refusable. But in parallel to all monitoring tasks is the need for geometric quantities in the sense e.g. of positions of objects in absolute sense or in relation to other objects or in distances between points on one object. To measure positions and other geometry related quantities a surveyor is needed to design, develop and implement the respective measurement systems as well as to evaluate and analyse the measured quantities. Therefore the knowledge of a geodetic engineer is non substitutable in any of the named early warning applications.

The Contribution of the Surveying Profession

As written before the main role of the surveyor is the one as a geodetic engineer that cooperates in an interdisciplinary team. One's duty is to deliver the geometric quantities required and – even more important – to describe the quality of the data in a way the other partners of the team may understand it and use it for their interpretation and their catastrophe forecasting models. Some of the most important tasks carried through by **the surveyor as a geodetic engineer** are

- design, development and implementation of measurement systems on the basis of the dynamic object model using e.g. methods of sensitivity analysis,
- process, evaluate and adjust the geodetic measurements, including models and analysis of time-dependent measurements as well as deformation analysis,
- develop and implement algorithms for data fusion, partly in cooperation with other disciplines that deliver measurement data too (e.g. geotechnical measurements),
- model, describe, measure and propagate the quality of geodetic data,
- manage and visualise measurements and results as well as
- coming to decision within the disaster risk management process in an interdisciplinary team.

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The Contribution of the Surveying Profession to Disaster Risk Management *(continued)*

The measurement instruments used for early warning systems depend on the required quality especially the accuracy demands as well as to the extension and the environment of the monitored object, area or region. So for tasks as early warning with respect to tsunamis or volcanic eruptions large areas or regions are monitored. Here satellite based positioning methods are applied. For small extensions as valid for constructions like bridges or dams and for e.g. landslides higher accuracy is required, so that tacheometers as well as other specialised instruments like digital levels, tiltmeters or inclinometers are in use. For an overview we refer to Foppe et al. (2004).

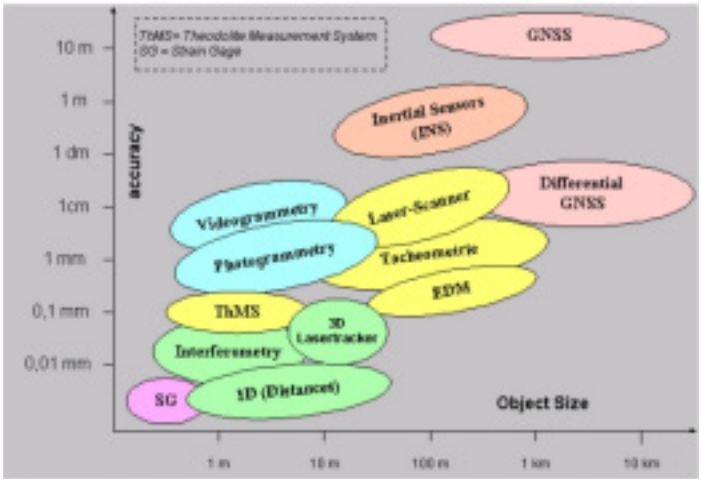

Figure 6: Measurement instruments in relation to accuracy and object expansion (Source: Foppe et al. 2004)

Good-Practice-Examples

Monitoring of slopes with respect to landslides

One typical example regarding early warning is the monitoring of slopes with respect to possible landslides. Regarding the behaviour of the slope one has to consider the landslide classification by the UNESCO Working Group for World Landslide Inventory (fig. 7) for the modelling as well as further information regarding the geological and tectonic background of the slope.

For this we need interdisciplinary teams consisting of geodesists and geologists. One of the first projects dealing with interdisciplinary research work was the "Geotechnical Information System" in cooperation of geologists from the Geological Institute Mainz and geodesist from the Geodetic Institute Hannover (Foppe

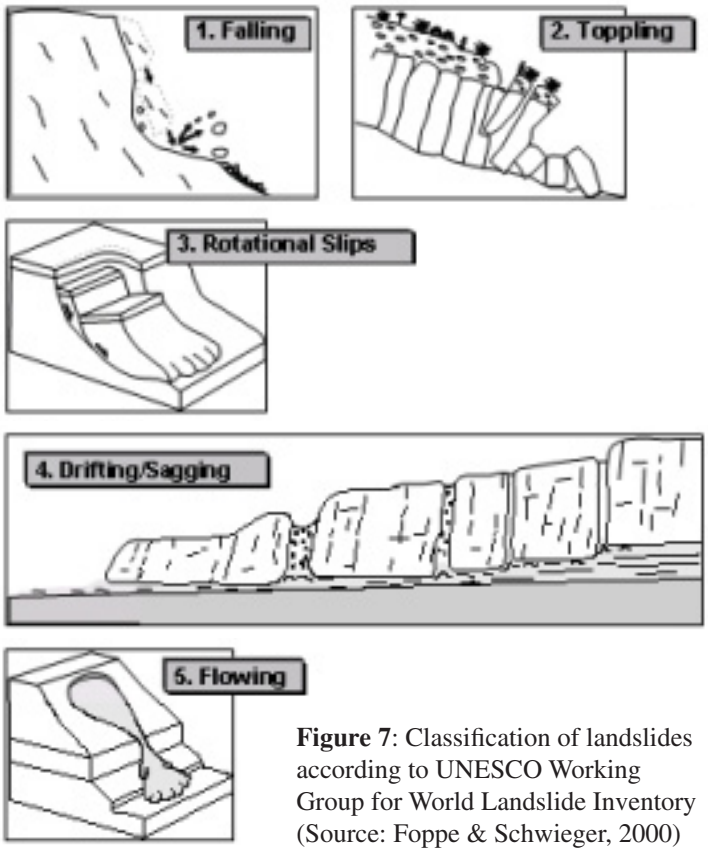

Figure 7: Classification of landslides according to UNESCO Working Group for World Landslide Inventory (Source: Foppe & Schwieger, 2000)

& Matthesius, 1994). The objective of the project was fast and precise monitoring of the actual state of the monitored slope. Different slopes in south Germany were investigated within this project. The geodetic as well as the geotechnical measurements were integrated in one information system that allows the analysis and interpretation of the results. The geodetic engineers were responsible for building up a Geotechnical Information System including data acquisition, management and deformation analysis.

This interdisciplinary cooperation example has taken its continuation in several scientific projects as well as practical implementations leading to an integration of the geodetic engineer into landslide monitoring projects due to his knowledge about data acquisition, data processing and modelling of the likely sliding slope. As an example the new project InterRisk (Integrative Landslide Risk Analysis and Perception in the Swabian Alb) as cooperation between geologists, geographers and geodesists may be given. Here among other things the derivation of correlations between external factors like rain fall and

geometric quantities, the measured deformations, are under research (e.g. InterRisk 2006, Schauerte et al. 2006).

Tsunami Warning System

On a larger scale tsunami warning systems are currently of high interest. For example the GeoForschungsZentrum Potsdam (GFZ) will co-develop a part of the IOTWS (Indian Ocean Tsunami Warning System) near Indonesia. This development is a German-Indonesian cooperation called GITEWS (German Indonesian Tsunami Early Warning System) granted by the German government (BMBF 2004).

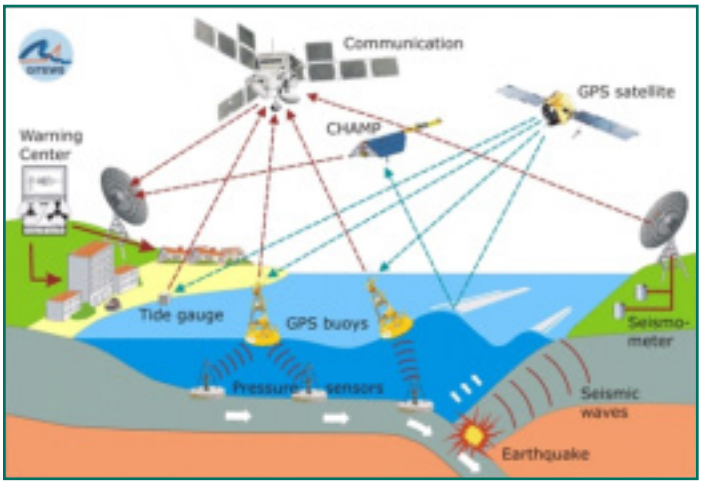

Figure 8: Indian Ocean Tsunami Warning System (Source: GFZ 2006)

The system will integrate terrestrial observation techniques like seismometers and tide gauge measurements by GPS as well as marine measurements on GPS buoys and with ocean bottom pressure sensors and the processing centre in Indonesia (compare fig. 8). The base is the already available global earthquake monitoring system of GFZ and its also available real-time communication technique. Overall the system consists of four chain links: the data acquisition, the data processing, the validation and the warning component. The final implemented system will have an open and modular character to ensure the possibility to be further enlarged without problems.

The development and implementation of the system is accompanied by capacity building in the sense of training of local scientists, engineers and decision makers in Indonesia regarding measurement techniques, tsunami modelling and information processing. In this way the technical objectives of the GITEWS are supplemented by additional efforts aiming to develop human skills to reduce the level of risk in Indonesia.

The GITEWS team is highly interdisciplinary consisting of geophysicists, hydrologists, computer scientists and of course geodetic engineers. The positive fact is that the scientists and engineers of this project have already done research in the same organisation like GFZ before project start. This illustrates the importance of interdisciplinary research centres for activities regarding disaster risk management and especially early warning systems.

The Way Forward

Still surveyors are seen as supplier of measured geometric data. This has to be changed dramatically. The geodetic engineer has to be an equal partner within the discussions. Even more the surveyor may play in important part in the decision process, since in general he delivers the respective geometric information that is essential for releasing an alarm in any early warning system. In other words the geodetic measurements drive the emergency planning tasks thus steering the whole process of disaster risk management in case of an impending event. This leads to the conclusion that the surveyor should be one of the key decision makers in any monitoring and early warning team.

Additionally the knowledge of surveyors regarding modelling of dynamic systems like construction or slopes should lead to an equal role for the evaluation and optimization of these dynamic models describing the behaviour of the monitored objects. In general the specialists that collaborate with the surveyors see any involvement into “their” objects and processes as a danger for their profession. This means that a civil engineer does not like discuss their dynamic construction models with geodesists and that geologists do the same with landslide models. We have to explain to our colleagues that a win-win situation is generated in case of shared knowledge. The interdisciplinary cooperation would be even more purposeful. Finally the assessment of risks would be possible with the help of geodesists in case of a real interdisciplinary cooperation.

3.3 Photogrammetry and Remote Sensing

Photogrammetry is an efficient tool in monitoring spatial objects due to location, form and shape. Its main advantage to other measuring techniques lies in the fact that the measurement is done on the images and indirect measuring possibility opens the users of this method a wide range of application possibilities. One of the contributions is the use of **terrestrial photogrammetric methods** to determine the monitoring, documenting and analyzing the damages in the structures after an earthquake. Today with the help of digital data capturing, on-line processing

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The Contribution of the Surveying Profession to Disaster Risk Management *(continued)*

techniques and automation of data evaluation by means of image analysis and matching techniques is enabled. In this context **3D-object reconstruction techniques**, classification or image detection and their integration into a deformation analysis procedure using information system technology is used. So after a short time and nearly on-line the deformations of the building can be determined and obtained, the displacements values are controlled with the values given in the "Structural Codes". With this very fast data acquisition technique the civil engineers gain an efficient tool to determine whether a damaged building will be kept for retrofitting or be demolished.

Aerial photogrammetric data acquisition techniques give very accurate data about the damaged area and are a very good tool for coordinating rescue operations after a disaster. The data gaining method named as LIDAR (= LIght Detection And Ranging) is a weather and day light independent method which provides data very fast and enables to detect the damaged parts of a city or residential areas automatically.

Earth observation satellites have demonstrated their utility in providing data for a wide range of applications in disaster risk management. Pre-disaster uses include risk analysis and mapping; disaster warning, such as cyclone tracking, drought monitoring, the extent of damage due to volcanic eruptions, oil spills, forest fires and the spread of desertification; and disaster assessment, including flood monitoring and assessment, estimation of crop and forestry damages, and monitoring of land use/change in the aftermath of disasters. Remotely sensed data also provide a historical database from which hazard maps can be compiled, indicating which areas are potentially vulnerable. Information from satellites is often combined with other relevant data in geographic information systems (GIS) in order to carry out risk analysis and assessment. GIS can be used to model various hazard and risk scenarios for the future planning and the development of an area.

A proposed concept of a geo-space system for prediction and monitoring earthquakes and other natural and man-made catastrophes, which is based on a system capable of monitoring precursors of earthquakes in the ionosphere and magnetosphere of the Earth and using these precursors to make short-term forecast of earthquakes. Investigations on the interaction between ionosphere's F layer variations and different variations occurring in circumterrestrial environment (atmosphere, ionosphere and magnetosphere) associated with seismic activity, and detected by means

Photo 3: High Resolution QuickBird image of the devastated area - Tsunami in Southeast Asia, December 26, 2004 (Source: Prof. Altan)

of ground base and satellite monitoring. This method and others like GPS measurements for long distances are providing useful parameters for earthquake forecasting.

Realizing the fact that the remotely sensed data can help very much for the disaster risk management, at its forty-fourth session, the Committee on the Peaceful Uses of Outer Space agreed to establish action teams composed of interested Member States in order to implement the recommendations of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III). One of the action teams focused on studying and recommending the implementation of an integrated operational global system, especially through international cooperation, to manage natural disaster mitigation, relief and prevention efforts through Earth observation, communications and other space-related services, making maximum use of existing capabilities and filling gaps in worldwide coverage. Several UN Member States expressed their support for the work being carried out by the action team, emphasizing the importance of creating an entity (DIMISCO; Disaster Management International Space Coordination Organization) in that it could promote more effectively the **application of space technology in disaster reduction and management** at the global level, and in developing countries in particular, and their preference of setting up such an entity under the umbrella of the United Nations in order to guarantee

universal access. It is planned that the proposed entity will be operational on 1 January 2007.

3.4 GIS and Geoinformatics

Spatial Data Information is one of the core subjects in disaster prevention and emergency aid. To guarantee, e.g., for speed and efficiency of rescue operations all information should be available at a glance in the control units and in the mobile rescue units as well. In an emergency case, not only the location of the event but many other information is needed. Like, how many people are affected? Which road network is available? Can the location be reached by vehicles? Where are the most nearby hospitals located? How much and which kind of capacity do the hospitals have? Such and many other questions can be answered very quickly if and only if reliable spatial data are available in digital form and if the data are processed in a powerful Geo Information System (GIS).

Recently, many **IT developments** took place which can help to speed up the information flow considerably. The **availability of Internet** access points, the widely common IT infrastructure within the Internet, the standardisation process defining spatial data processing procedures all together provide for the IT base of a spatial data infrastructure to support a powerful spatial information management which can be used as a valuable source of suitable disaster management. The spatial data infrastructure should be consistently implemented across sub-national and national boundaries because disaster areas typically do not coincide with administration boundaries.

Geo Information Systems can help to support all phases of emergency management, like mitigation, preparedness, response and even recovery.

Depending on the specific tasks, **different types of GIS** are to be used:

- Spatial information portals and data warehouses
- Modelling and simulation systems
- Monitoring and early warning systems
- Planning support systems

Special tasks which can be performed in such a GIS system may include:

- Use of spatial data and object related data from various sources
- Integration of mobile action force information in near real-time
- Providing adequately processed intersected data including decision support signals for control centres and field staff
- Information retrieval support
- Information intersection support
- Decision process support
- Scenario projection of retrieved intersected information
- Database of predefined scenarios
- Extension of existing databases and cadastres
- Connection of existing disaster management systems via open standard interface
- Logging of activities for the purpose of documentation

Contribution of the Surveying Profession

Traditional skills of a surveyor, like **quality awareness**, are a valuable contribution and can help to support the quality assurance of spatial data and of spatial information processes as well. Spatial data processing needs the **data management capabilities** of surveyors. In the field of land information systems, surveyors possess a sound experience in maintaining huge spatial databases at a very high level of reliability since a long time. This knowledge can be used to support the implementation of other but, technically spoken, similar spatial information systems which provide for an absolutely indispensable base for the effective disaster risk management.

Acknowledgements

This report has been prepared by the FIG Working Group 8.4, *Disaster Risk Management*', which was created in December 2003 during the 2nd FIG Regional Conference in Marrakech, Morocco, within commission 8 - Spatial Planning and Development. The objective of the group, chaired by Prof. Dr.-Ing. **Theo Kötter** (University of Bonn/Germany), was to analyze systematically the contribution of the surveying profession to disaster risk management, including case studies and best practices. The members of the group are:

Volker Schwieger, University of Stuttgart, Germany [primary author responsible for section 3.2]
Orhan Altan, Istanbul Technical University, Turkey [primary author responsible for section 3.3]
Hartmut Müller, FH Mainz, University of Applied Sciences, Germany [primary author responsible for section 3.4]
Frank Friesecke and **Theo Kötter**, University of Bonn, Germany [primary authors responsible for section 3.5]

FIG PUBLICATION NO. 38

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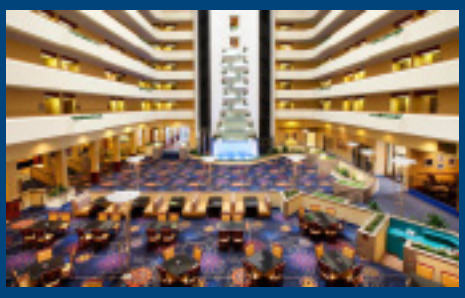

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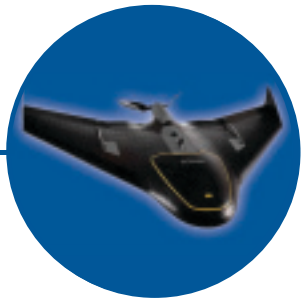

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Missouri's First USPLSS Corner

by Dr. Dick Elgin, Rola, Missouri

In the previous edition of "Missouri Surveyor," the question was:

"Excluding U.S. Surveys, where is the location of the first corner of the USPLSS to be monumented in what became the State of Missouri?"

If you had an inkling the first USPLSS corner would have been on the 5th Principal Meridian, you were correct. The contest winner is Ron Lather, PS with the Department of Agriculture, Land Survey Program. Ron wins an autographed copy of a 2006 "Sokkia Ephemeris." Here's the whole story on Missouri's first USPLSS corner.

After establishing the Initial Point for the 5th P.M. on November 16, 1815 (with Joseph C. Brown who was surveying the Base Line), Prospect K. Robbins (1788-1847) and his crew began surveying north, establishing the Principal Meridian. Robbins set a monument every 40.00 chains, those corners being the standard corners to the Meridian. He was surveying through the wilderness which at that time was part of the Missouri Territory. On December 28, he reached the south bank of the Missouri River (just downstream from what is today Washington, Missouri), having completed his contract to survey the Meridian. (It would be extended later.) He had averaged 6.2 miles per day. (Robbins' survey of the 5th P.M. was not without its errors. See Chapter 2, Sections B, C, D in *"The U.S. Public Land Survey System for Missouri."*)

When Missouri became a state in 1821, the south boundary was to be 36°00' north latitude for the boot heel and 36°30' for the rest of the state. In September of 1823, Joseph C. Brown began at the mouth of the Kansas River on the south bank of the Missouri River (downtown Kansas City, today) and surveyed south "along the meridian." When he got to his position for 36°30' latitude, the southwest corner of the state he turned "east" and surveyed the state's south boundary line. On November 30, he "intersected the meridian line" (5th P.M.) 28.50 chains south of the township corner to T21N and T22N (being on the P.M., that would be between R1W and R1E, of course).

Although in his notes Brown doesn't comment, but this must have been a proud moment. To cross the 5th P.M. eight years after his peer Prospect Robbins had surveyed it, and from the Initial Point established by Brown himself!

This intersection point is not monumented today…and… the line surveyed by Brown in 1823 is not the state line today. As with some other Missouri boundaries, it's a long story. (See Chapter 1, Section C., Missouri's Boundaries in *"The U.S. Public Land Survey System for Missouri."*) Brown's 1823-1824 south boundary of Missouri was resurveyed in 1843-1844 by Bazil Gordon. At the 5th P.M., Gordon's state line (adopted by both states) is south of Brown's 1823 state line.

So, the first monument set along the 5th P.M. north of the state line is the T21N, T22N township corner. It becomes the first USPLSS established in the State of Missouri. Prospect K. Robbins set it on December 5, 1815.

So, where are you going to be on Saturday, December 5, 2015, the 200th birthday of the USPLSS in Missouri? Perhaps MSPS should organize a lunch at the corner to remember, honor and toast all the early GLO Deputy Surveyors of Missouri, particularly Prospect Robbins and Joseph Brown. Today the position is marked by a Department of Agriculture monument.

Missouri USPLSS Quiz No. 2

A Contest to Identify the Most Unusual Missouri Township

by Dick Elgin

For several reasons there are many, many odd and unusual townships in Missouri. Grant boundaries, U.S. Surveys, our many rivers, the spacing of our Standard Lines, etc., are all factors which create irregular townships. Unlike what the standard textbooks my say about townships, all are not square and contain 36 sections. Of the 2063 townships in Missouri, I'd bet you a cheeseburger the majority of them are more unusual than usual.

So, Quiz No. 2 is for you to propose Missouri's most unusual township. Email me the Township and Range number or your candidate for the designation "Most Unusual Missouri Township." Feel free to nominate more than one. I will look at the plats and proclaim the winning township. The nominator will win an autographed 2002 "Sokkia Ephemeris." Ties will be arbitrarily and capriciously decided by the contest judge (me).

Dick Elgin, elgin@rollanet.org

FUTURE MOCK TRIAL

The education committee is seeking information on a property dispute that could be used in the future for a Mock Trial. Information submitted should include what was in dispute, maps and/or plats, what state statutes or minimum standards were violated if any.

Individuals submitting should be willing to assist in preparation of the Mock Trial.

Please submit information to Dan L. Govero at dgovero@goverolandservices.net.

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Davis-Bacon Misapplied

by John "JB" Byrd, John M. Palatiello & Associates, Inc., NSPS Legislative Consultants

T he surveying community is facing the most serious threat to its professional image in decades. The U.S. Department of Labor – without consultation with the community, public notice, or opportunity for public comment – issued an order on March 22nd declaring that members of survey crews are "laborers and mechanics" subject to the controversial Davis-Bacon Act. Since then, I've spent considerable time developing and implementing a strategy and engaging in lobbying to affect a reversal of that policy.

The Davis-Bacon Act is a controversial Depression-era law, with a highly racial origin, that requires the payment of the local "prevailing wage" to "laborers and mechanics" on federally funded construction projects. It applies to prime contractors and subcontractors on direct federal contracts, as well as to state and local governments expending funds through a federal grant or loan.

This prevailing rate of wages is above the minimum wage provided in the Fair Labor Standards Act. One of the controversies over implementation of the Davis-Bacon Act is that while it calls for the "prevailing" wage, how those wages are calculated is not reliable, with allegations by many that the Labor Department imposes the "union wage" rather than a real market-based wage. The nonpartisan Government Accountability Office, the watchdog agency of Congress, has long recommended that Davis-Bacon be repealed.

When issuing its new rule in March, the Labor Department reversed more than 50 years of policy. Since 1955, survey crews have been considered largely exempt. Arthur Goldberg, then-secretary of labor under President John F. Kennedy issued an opinion in 1962 stating that members of survey crews were exempt from DavisBacon, except to the extent to which they "perform manual work, such as clearing brush and sharpening stakes," which he said "are not commonplace."

The March 2013 ruling came at the urging of the International Union of Operating Engineers. Ironically, very few survey crew members belong to a union, and even fewer are members of the Operating Engineers. There has been no legislation, court ruling, comptroller general decision, or other governmental action that changed Secretary Goldberg's interpretation.

NSPS has strongly objected to the Labor Department classification of members of survey crews as laborers and mechanics, stating it's "an affront to the surveying profession" and "detrimental to our profession and an inappropriate demotion of valued and skilled employees."

There are many substantive reasons the Labor Department's new policy is erroneous. NSPS administers a "Certified Survey Technician" (CST) program for employees of surveying firms, including those who perform field survey functions. The classification of members of survey crews as "laborers and mechanics" is inconsistent with the CST program and the standard in the surveying community.

Moreover, classification as laborers and mechanics is in direct contrast with the treatment of such workers promulgated elsewhere in the Department of Labor, including the Occupational Employment

Statistics, the Occupational Outlook Handbook, and the Occupational Information Network. The Office of Personnel Management General Schedule Qualification Standard for GS 817 surveying technicians employed by the federal government also considers such workers at a scale well above "laborers and mechanics."

Some people might ask why NSPS would oppose higher wages for survey technicians. In testimony before Congress in a hearing held on June 18th, Curtis Sumner, LS, executive director of NSPS, said, "There is no evidence that members of survey crews are paid substandard wages and no demonstrated need for including such workers in a 'prevailing wage' law, based on Bureau of Labor Statistics data." That Labor Department data shows the mean annual wage for a surveying technician is $42,680, while the mean annual wage for all occupations in the United States workforce is $45,790, both figures exclusive of fringe benefits. Surveying technicians' earnings are not substandard, but virtually in the middle range of all United States' workers. The premise of the Davis-Bacon Act – to prevent construction firms from bidding low to win contracts through substandard wages – is not found in the surveying community.

Sumner also informed Congress that implementation of DavisBacon "will be an administrative nightmare for surveying firms, contracting agencies, and the Labor Department. The order itself is vague with regard to which members of survey crews, and which activities, and at what phase in a project the surveying service is being provided. This will result in confusion and costly compliance issues." He said that a letter the Labor Department sent to the Operating Engineers Union suggests the Davis-Bacon Act applies to "work immediately prior to or during construction which involves laying off distances and angles to locate

construction lines and other layout measurements. This includes the setting of stakes, the determination of grades and levels and other work which is performed as an aid to the crafts which are engaged in the actual physical construction of projects ... The chainmen and rodmen whose work is largely of a physical nature such as clearing brush, sharpening and setting stakes, handling the rod and tape and other comparable activities are laborers and mechanics..."

The act triggers application to a "laborer and mechanic" when more than 20% of the workweek is in the performance of such services on a covered site. Sumner said, "Survey crews are not like construction workers. A survey crew member may be on a construction site a few hours a day, one day a week, and otherwise on a sporadic and intermittent basis, but rarely an entire 40-hour work week. Some work may be preliminary to construction, postconstruction, or not related to construction at all. Documenting what every survey crew member is doing every hour of the work day, determining whether an activity is covered or not covered, construction-related or not, is an expensive, time-consuming and counter-productive burden. The payroll administration required for compliance for a surveying profession dominated by very small businesses is extraordinary."

He said, 'The described activities are outdated and irrelevant to today's surveying. The Labor Department attempts to distinguish between licensed professional surveyors, party chiefs, and technicians, such as rod men and chainmen. However, with today's computerized data collectors, survey crews can commonly consist of one person. That individual is certainly exercising judgment and working in a supervisory capacity. Today's surveying technicians are performing services that are mental and managerial in nature and are not 'apprentices, trainees, helpers, and, in the case of contracts subject to the Contract Work Hours and Safety Standards Act.' Therefore, they do not meet the criteria for a laborer or mechanic."

In addition to formally writing the secretary of labor asking that the ruling be repealed, NSPS was successful in securing the June 18th congressional hearing at which it testified. The surveyors' society has led a multipronged strategy to restore classification of survey technicians as an important support cast to the surveying profession. After the hearing, three members of Congress wrote to the Labor Department demanding documents related to the expansion of Davis-Bacon to survey crews. Professional Surveyor Magazine has filed a request for documents under the Freedom of Information Act. A coalition of 13 taxpayer and free market organizations wrote the Secretary of Labor in opposition to the ruling, as did five design and construction organizations.

The issue is not pay, but prestige. NSPS is currently scheduling a meeting with Labor Department officials to press its case for proper classification of valued technicians who support the profession of surveying.

John JB Byrd is the government affairs manager for John M. Palatiello & Associates, a public affairs, association management and consulting firm in Reston, VA. He has more than 10 years of public-policy experience. He is the registered lobbyist for the National Society of Professional Surveyors (NSPS) and the government affairs manager for MAPPS, the national association for private-sector geospatial firms.
Reprinted from the Society of Land Surveyors of Iowa's publication, Random Lines November 2013

Iowa Engineer *(continued)*

In Alvin Toffler's 1970 book "Future Shock," he predicted that the accelerated pace of technological development would have a profound effect on civilization, and he recognized that the disjunction between technological changes and human adaptation to them could be the source of major problems.

He highlighted the fast rate of change and its displacement of technical matters taught in school — a concept readily adaptable to what is occurring in the construction industry, particularly as surveying technology advances more quickly than our acclimatization to dealing with potential discrepancies in the information provided by new methodology.

Staking is the point of convergence where technology and the digital model meet reality. With the art and science of staking changing at a high rate, this industry must learn to adapt.

With approximately 100,000 engineering firms nationwide, how does the discussion begin, and will it result in any practical solutions before new technology supplants the current methodology, bringing with it a new set of challenges?

*Dave Moeller, vice president of Iowa-based Snyder & Associates Inc.

Advancements in Global Navigation Satellite System (GNSS) Surveying with BeiDou Satellites

by Nick Talbot/Timble Fellow/Senior Software Engineer

The United States has provided the world with free access to the signals from the Global Positioning System for more than two decades. The multi-billion dollar investment in GPS has spawned a revolution of positional awareness across the world and helped to improve many aspects of survey data acquisition. Since the development of GPS, Russia has followed with GLONASS, Japan with their Quasi-Zenith Satellite System (QZSS). More recently China, has unveiled their BeiDou system and the European Union with Galileo. The following article briefly examines China's BeiDou System, and provides some insight on how the new satellites and signals will help to improve surveying in Victoria.

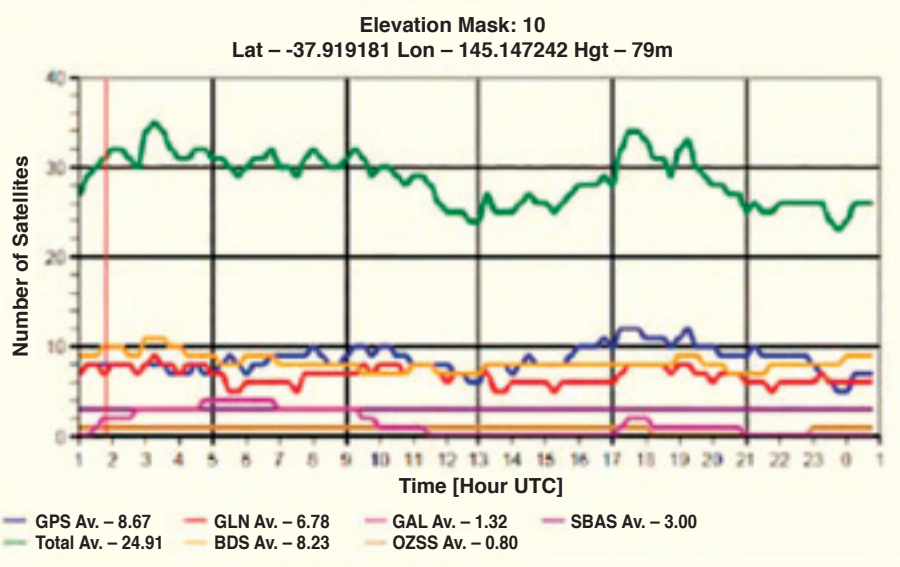
The Global Positioning System has around 30 satellites in medium earth orbit (MEO). At any one time, we typically see 6-14 GPS satellites above our local horizon. For centimetre-level, Real-Time Kinematic (RTK) positioning applications used by surveyors, weneed at least 4 GNSS satellites to obtain a fix, but in reality 5 and preferably more satellites should be used. An increase in the number of satellite signals tracked leads to improved availability. Having overdetermined observations should be a familiar concept to surveyors. The addition of around 24 GLONASS satellites has nearly doubled the number of GNSS satellites in view. This has allowed RTK operation in environments where some of the satellite signals are obstructed.

Apart from improving positioning availability, having more satellites helps to improve position accuracy. A dominant error in RTK positioning is due to signal multipath. With multipath, rather than just receiving the direct signal from a satellite, signals are reflected from objects near the antenna. This introduces cm-level errors in the respective user-satellite range measurements. Multipath errors are dependent on the satellite-reflector-antenna geometry. Therefore multipath errors tend to average out when satellites from different parts of the sky are used in the position solution.

BeiDou, is the Chinese equivalent of GPS. The system currently consists of 14 satellites: 5 in equatorial geosynchronous (geostationary - GEO) orbits; 5 with inclined geosynchronous orbits (IGEO) ; and 4 medium earth orbit (MEO) satellites. The BeiDou geostationary and inclined geosynchronous satellites are configured to provide good coverage over China. Fortunately, this configuration also yields excellent coverage over Australia. Today, it is normal to see 6-12 BeiDou satellites above 10 degrees elevation over Victoria at all times (see satellite availability plot). China plans to add medium earth orbit satellites for global coverage over the next 5 years, bringing the total BeiDou satellite count to 35.

The BeiDou signals are broadcast on three frequency bands, B1, B2 and B3, which all differ from the GPS L1,

(continued on page 34)



Twenty-four hour visibility plot for Melbourne, with satellites above 10 degrees elevation. The plot includes the following GNSS satellites: GPS, GLONASS (GLN), Galileo (GAL), BeiDou (BDS), Quasi-Zenith Satellite System (QZSS) and Satellite Based Augmentation Systems (SBAS). At times the number of BeiDou satellites in view exceeds the number of GPS satellites. The QZSS satellite is seen for around 19 hours; all 4 Galileo satellites are visible for only 2 hours a day. Note that the SBAS satellites are not generally used for RTK applications.

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Advancements in Global Navigation Satellite System (GNSS) Surveying with BeiDou Satellites *(continued)*

L2 and L5 bands. Therefore, special antenna and receiver hardware is needed to track and use BeiDou signals. In the coming years, new BeiDou satellites are expected to move their B1 band to GPS L1, thus providing a level of compatibility across satellite systems.

For the past 12 months, Trimble has been shipping the NetR9 infrastructure receiver, the R10, R8, R6 and R4 survey systems, which are all capable of tracking and using BeiDou satellites for RTK positioning. The inclusion of BeiDou satellite signals provides a significant improvement to the integrity of the solution. Furthermore, there is a noticeable reduction in peak-to-peak position errors for RTK surveying, particularly in high multipath environments.

Many surveyors in Victoria obtain RTK correction signals from the world-class GPSnet reference station network, established by the State Government, Department of Environment and Primary Industries. At present GPSnet infrastructure only supports GPS and GLONASS data. However approximately 10 reference stations have been established to form a sub-network around the Melbourne metropolitan area with QZSS and BeiDou support. There is a desire to upgrade the entire state-wide network to support all GNSS signals in the future. BeiDou rover equipment will not see the full state-wide benefit from GPSnet until all reference stations in the network are upgraded. However, GNSS users with their own BeiDou-capable reference and rover equipment can enjoy the full benefits of the Chinese system today.

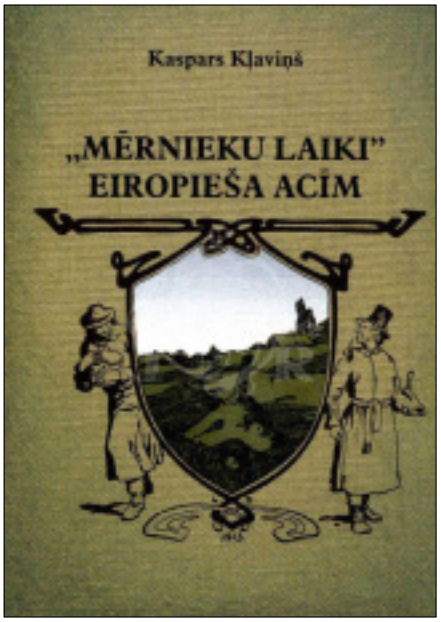
Europe's Galileo system is gathering momentum now, with 4 satellites in space. The Japanese QZSS has one GPS-like satellite in space today over Asia and Australia, with more QZSS satellites to follow. By 2015 we can expect to see 90 satellites circling the globe and by 2020, the number will grow to 120. GNSS users in Australia will be the beneficiaries of satellite coverage that is heavily biased towards our region. The availability and integrity of high-precision GNSS surveying will be greatly enhanced by the expanded satellite signals.

Who Knew?

Book: Times of the Land Surveyor, Latvian Title: Mērnieku laiki

by Kaudzīte, Reinis; Kaudzīte, Matiss

English Editorial:"Mērnieku laiki" (Times of the Land-Surveyors, 1879) is the first novel written in Latvian; its authors were two teachers, brothers Reinis (1839–1920) and Matīss (1848-1926) Kaudzīte. The influence of the novel on Latvian literature has been compared to that of "Don Quixote" by Cervantes on Spanish literature. The plot of "Mērnieku laiki" is based on the events during land surveys in late 19th century; however, the novel has a particularly multilayered plot, intertwining the land surveys and the related intrigues, a tragic love story, relations between individual farms and two parishes and plot devices borrowed from crime novels and pulp fiction works, namely a murder and the abduction of the head surveyor. The novel portrays all contemporary classes and psychological types and includes both comic and tragic elements.



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City Plots Future Using 3-D Scans

Gear details U.S. 76 area for projects in Branson

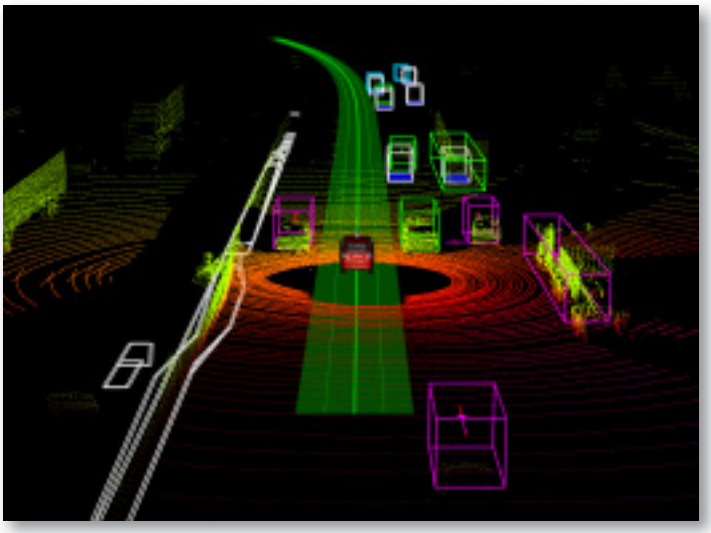
by John Magsam, Reprinted from *Arkansas Democrat-Gazette*, March 2014

BRANSON — The main drag through the tourist town of Branson is being scanned with invisible rays.

Beams are bouncing along U.S. 76 to map the roadway that's the home to Dolly Parton's Dixie Stampede, the Hollywood Wax Museum with its gigantic King Kong leaning over traffic, the Titanic Museum Attraction ocean liner facade seemingly about to knife across the roadway, and hundreds of other closely packed shops, restaurants, theaters and attractions.

The city is mapping this vital corridor using LiDAR, also known as light detection and ranging, as part of the planning process. The system uses laser pulses to gather three-dimensional structural information from millions of data points. The information will be used to get vital details about the cluttered roadway.

Branson is a city that thrives on tourism and tourists flock to U.S. 76. The often-jammed roadway is a peril to pedestrians, and is marred by looming power lines, so a revitalization project is underway. The information gathered won't only be used for simple mapping, said Sabin Yanez, senior vice president with Cook, Flatt and Strobel Engineers, which has Missouri offices in Kanasas City, Springfield and Branson. He said the system will provide the data, including three-dimensional photography, to formulate a real vision of what the roadway could look like in the future. Perhaps even more importantly, the system gives the company the ability to communicate that vision to all the businesses and city residents it will affect.

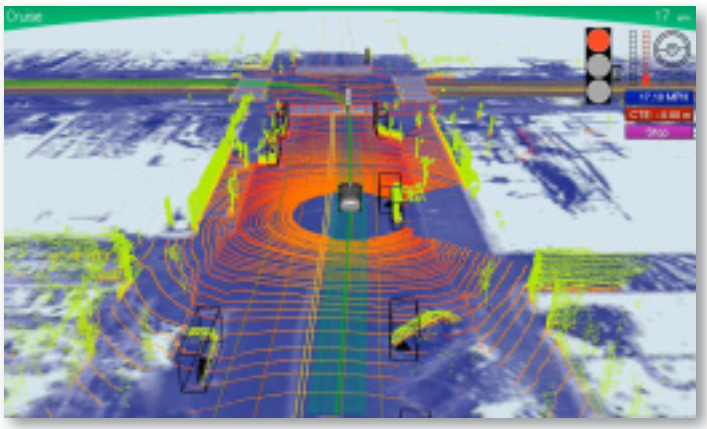


"This system makes it much easier to show the data," Yanez said.

The New Spirit of 76 revitalization plan targets 5 miles of U.S. 76 starting just east of U.S. 65. It's expected to cost $80 million to transform the roadway over four to six years.

The redesign includes plans for promenades, lighting, landscaping, gathering points, removal of utility poles and lines, and dealing with traffic congestion. The project's goal is to create a corridor that will help retail and entertainment venues along the roadway, promote more private investment and efficiently move travelers to their destinations.

Yanez said of the 5-mile stretch of road there are nearly 3 miles that are either driveways, curb-cuts or intersections. He said a project goal is to eliminate a mile's worth of those features. The city is paying just shy of $100,000 for the mapping services.



Cook, Flatt and Strobel Engineers, purchased a truckmounted LiDAR system recently and had one of its employees trained to use the system, in part, to support its Branson project. Yanez said the new gear also will be used on other contracts, particularly those serving railroads and the state highway departments, which favor surveys using the system.

"LiDAR was becoming more important to our clients," Yanez said.

Malcolm Williamson, research associate at the Center

for Advanced Spatial Technologies at the University of Arkansas at Fayetteville, said the technology, commonly called highdensity surveying, can virtually measure everything a device can "see" up to its range limit. He said the stored information is a treasure trove of data, that can be accessed later if plans change or different measurements are needed.

He said the technology is becoming more common but its still expensive, so it's used primarily by larger surveying companies and engineering operations, like Cook, Flatt and Strobel..

Curtis Sumner, executive director of the National Society of Professional Surveyors, said use of the system is becoming more popular around the courtry, with aerial units used to map large expanses of territory and with ground units used most often in corridor mapping. As opposed to conventional surveying, which is somewhat limited in scope, the systems not only offer information about the ground but what's on it, from trees, buildings, signs and above-ground utilities, he said.

"It just picks up everything," he said.

Williamson said LiDAR began to be used for mapping, primarily from aircraft in the mid-1990s, but advances allowing it to perform 360-degree scans made ground units feasible starting around 2000. Devices went from emitting about 2,000 laser pulses when the technology was first used to 1 million today.

He said combined with 3-D photography, high-density surveying allows highly accurate visual records and the ability to make computer models that show how changes will look, right down to the proper colors.

So far, the main 5 miles of U.S. 76 have been scanned, which took about a month. Several days of surveying were lost because of poor weather conditions, mainly snow, which can throw off readings. Next comes about 5 miles of scans featuring roadways that feed into U.S. 76.

Kyle Madrid, field survey chief for Cook, Flatt and Strobel, is in charge of the survey of Branson. He said the system uses established GPS waypoints as a reference to establish where it is. Then, once a primary scan is completed, it leap-frogs forward, using some of the known points as a base and weaving in new points into the established information. He said the system can scan up to about 3,300 feet, but typically scans encompass smaller areas.

We're Back at the Fair!

We are back, and August 7-17, 2014 will be Missouri Society of Professional Surveyors' 4th year with you, our members, interacting with and educating the public. This gives our Society a great means to have professional Surveyors available to interact with and educate broad, cross sections of the public. This has been a unique partnership between a public agency (Land Survey Program and Department of Agriculture) and the Missouri Society of Professional Surveyors (YOU!) coming together for the benefit of the public.

Our goal is and will remain simple. It is to make the professional available to the public. There is no "typical" fairgoer. Mostly, we have "just" folks stopping by. Some stop to look at the displays, ask a few questions about surveying, and move along. Some bring their kids by and point to an instrument and say "we see guys with these standing beside the road all the time." Still others say surveyors never agree so what's the point, and some have very real boundary issues and need a surveyor. These are all opportunities. Listen to them. Discuss the research involved, the gathering of record evidence, the gathering of field evidence, and the services only you the Professional Surveyor can provide. Answering questions and entering into discussions with the public is educating the public. Some results are tangible, and you can see the impact and influence being created. A membership directory is kept on hand, and they are referred to our member listing by County to find a Surveyor in their area.

You never know who is walking up to the booth dressed in casual summer wear for a day at the Fair. On one morning, a woman came to the booth asking questions. She became unusually specific about licensing and getting started in our profession. When asked about her curiosity it was discovered that she was a High School Guidance Counselor from Minnesota. She saw our booth and wanted to gain knowledge about Surveying for her students. Another was a advisor to the High School organization, Future Farmers of America (FFA). Their questions were cheerfully answered, further discussion was generated and educational/promotional materials were distributed. These two alone will have a direct influence on, and can help lead youth into our most honorable profession. The measure of that successful influence won't be known for years to come. However, it is one of the most important reasons to conduct these efforts. Other notable folks stopping by were County Commissioners, County Recorders; Judges, and one of our state Representatives. There is no doubt that many other influential community leaders anonymously stop by.

We need your help!

We need your continued personal and professional interest and support to make this a success. Success lies in the effort of you, the individual Professional Surveyor, getting involved and making a difference for the future of our time honored noble Profession. ***We need your time, your ideas, and most of all we need you.*** MSPS won't make this a success. It can only be successful if we as members step up and make it successful. It's time once again to be proactive representatives of our profession, and we will have some fun along the way. We MUST staff the booth every day of the fair, August 7th thru the 17th.

Make your commitment and sign up on the MSPS website at http://www.missourisurveyor.org.

2014 MSPS Corporate Members

Firm	Street_Address	City/State/Zip	Office_Phone	Email	Website
ABNA Engineering, Inc.	4140 Lindell Blvd.	St. Louis, MO 63108-2914	314-454-0222	aadewale@abnacorp.com	www.abnacorp.com
Affinis Corp.	7401 W. 129th St., Ste. 110	Overland Park, KS 66213	913-239-1100		www.affinis.us
Allstate Consultants, LLC	3312 Lemone Industrial Blvd.	Columbia, MO 65201	573-875-8799		
Amsinger Surveying, Inc.	101 S. Crittenden, Rm. B-3	Marshfield, MO 65706	417-859-5516	dennis@amsingersurveying.com	
Anderson Engineering, Inc.	2045 W. Woodland	Springfield, MO 65807	417-866-2741	sbrady@aeincmo.com	www.aeincmo.com
Anderson Survey Company	203 NW Executive Way	Lee's Summit, MO 64063	816-246-5050	jsa@andersonsurvey.com	www.ndersonsurvey.com
Bader Land Surveying, Inc.	16255 Sugar Bottom Road	Ste. Genevieve, MO 63670-8613	573-483-2777	baderls@brick.net	
Bartlett & West, Inc.	1719 Southridge Drive, Ste. 100	Jefferson City, MO 65109	573-634-3181		www.bartwest.com
Bax Engineering Co., Inc.	221 Point West Blvd.	St. Charles, MO 63301	636-928-5552	dbax@baxengineering.com	www.baxengineering.com
Bowen Engineering & Surveying, Inc.	2121 Megan Drive	Cape Girardeau, MO 63701	573-339-5900	info@bowenengsurv.com	www.bowenengsurv.com
Buescher Frankenberg Associates, Inc.	103 Elm St.	Washington, MO 63090	636-239-4751	mail@bfaeng.com	www.bfaeng.com
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Cardinal Surveying & Mapping, Inc.	PO Box 278	Cottleville, MO 63338	636-922-1001	shelly@cardinalsurveying.com	www.cardinalsurveying.com
Central MO Professional Services, Inc	2500 E. McCarty	Jefferson City, MO 65101	573-634-3455	kbrickey@cmps-inc.com	www.cmps-inc.com
Cochran	530 A E. Independence Dr.	Union, MO 63084	636-584-0540	mail@cochraneng.com	www.cochraneng.com
Cole & Associates, Inc.	401 S. 18th St, Ste. 200	St. Louis, MO 63103	314-984-9887	twesterman@colestl.com	www.colestl.com
Doering Engineering, Inc.	5030 Griffin Road	St. Louis, MO 63128	314-487-6913	mdoering@doeringeng.com	www.doeringengineering.com
Engineering Solutions	50 SE 30th Street	Lee's Summit, MO 64082	816-623-9888	esinfo@es-kc.com	www.engineeringsolutionskc.com
Frontenac Engineering Group, Inc.	2725 Sutton Blvd. B	St. Louis, MO 63143	314-644-2200	billb@fe-stl.com	www.fe-stl.com
George Butler Associates, Inc.	9801 Renner Blvd.	Lenexa, KS 66219-9745	913-492-0400		www.gbateam.com
Govero Land Services, Inc.	5929 Old State Rd.	Imperial, MO 63052	636-464-9380	glsland@goverolandservices.net	www.goverolandservices.com
Grimes Consulting Inc.	12300 Old Tesson Road, Ste. 300 D	St. Louis, MO 63128	314-849-6100		www.grimesconsulting.com
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Integrity Engineering, Inc.	PO Box 700, 1714 E 10th Street	Rolla, MO 65402	573-341-2100	terris@integrityeng.com	www.integrityeng.com
John R.M. Nelson, Inc.	PO Box 482	Bolivar, MO 65613	417-326-2777	jnjnkn@yahoo.com	
Koehler Engineering & Land Surveying, Inc.	194 Coker Lane	Cape Girardeau, MO 63701	573-335-3026	ckoehler@koehlerengineering.com	www.koehlerengineering.com
Marler Surveying Co., Inc.	11402 Gravois Rd., Ste. 200	St. Louis, MO 63126	314-729-1001	marler@marlersurveying.net	www.marlersurveying.com
Midland Surveying, Inc.	501 N. Market	Maryville, MO 64468	660-582-8633	tryhayes@midlandsurvey.com	www.midlandsurvey.com
Migar Enterprises, Inc.	PO Box 528	Grandview, MO 64030	816-966-0839		
Minnick Surveying, LLC	7905 Big Bend Blvd., Ste. 101	Webster Groves, MO 63119	314-721-9500	info@minnicksurveying.com	www.minnicksurveying.com
Musler Engineering Co.	32 Portwest Court	St. Charles, MO 63303	636-916-0444	6rich@muslereng.com	www.muslereng.com
Olsson Associates	7301 W. 133rd St., Ste. 200	Overland Park, KS 66213	913-381-1170	pward@oaconsulting.com	www.oaconsulting.com
Pellin Surveying LLC	208 South Church Street	Union, MO 63084	314-985-5263	pellinsurveying@gmail.com	www.pellinsurveying.com
Phoenix Engineering & Surveying, LLC	3855 S. Northern Blvd	Independence, MO 64052	816-743-9000	wes@phoenix-llc.com	www.phoenix-llc.com
Pickett, Ray & Silver, Inc	22 Richmond Center Court	St. Peters, MO 63376	636-397-1211	dskornia@prs3.com	www.prs3.com
Pitzman's Co. of Surveyors & Engineers	2725 Sutton Blvd.	St. Louis, MO 63143	314-781-5665		
Poepping, Stone, Bach & Associates, Inc.	801 Broadway, Ste. 224, PO Box 190	Hannibal, MO 63401	573-406-0541	psba@psba.com	www.psba.com
Riggs & Associates, Inc.	102 W. Trish Knight St., PO Box 71	West Plains, MO 65775	417-256-8125	ralphr@riggslandsurveying.com	www.riggslandsurveying.com
Robert S. Shotts, Inc.	267 East Third Street	Lebanon, MO 65536	417-588-7877	bob@shottsinc.com	www.shottsinc.com
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Schlagel & Associates, PA	14920 W. 107th St.	Lenexa, KS 66215	913-492-5158		www.schlagelassociates.com
Schmitz, King & Associates, Inc.	18900 West 158th St., Ste. G	Olathe, KS 66062	913-397-6080	dave@schmitzking.com	www.schmitzking.com
Shafer, Kline & Warren, Inc.	1700 Swift Ave., Ste. 100	N. Kansas City, MO 64116-3821	816-756-0444	graham@skw-inc.com	www.skw-inc.com
Shaffer & Hines, Inc.	PO Box 493	Nixa, MO 65714	417-725-4663	chines@shafferhines.com	
St. Charles Engineering & Surveying, Inc.	801 S. Fifth St., Ste. 202	St. Charles, MO 63301	636-947-0607		www.stcharleseng.com
Surdex Corporation	520 Spirit of St. Louis Blvd.	Chesterfield, MO 63005	636-368-4400	brianh@surdex.com	www.surdex.com
Taliaferro & Browne, Inc.	1020 E. 8th St.	Kansas City, MO 64106	816-283-3456		www.tb-engr.com
The Sterling Company	5055 New Baumgartner Road	St. Louis, MO 63129	314-487-0440	ggower@sterling-eng-sur.com	www.sterling-eng-sur.com
Thouvenot, Wade & Moerchen, Inc.	4940 Old Collinsville Road	Swansea, IL 62226	618-624-4488	dtwente@twm-inc.com	www.twm-inc.com
Tri-State Engineering, Inc.	702 S. Main St.	Joplin, MO 64802	417-781-0643	slewis@tristate-engineering.com	www.tristate-engineering.com
West Wildwood Surveying, LLC	8023 Waddell Avenue	St. Louis, MO 63125	636-394-6090	wwsurv@att.net	
Whitehead Consultants Inc.	114 N. Main St.	Clinton, MO 64735	660-885-8311	mtaylor@wcieng.com	
Zahner & Associates, Inc.	26 N. Jackson St.	Perryville, MO 63775	573-547-1771	zahner@zahnerinc.com	www.zahnerinc.com

Missouri Society of Professional Surveyors
P.O. Box 1342
Jefferson City, Missouri 65102