Missouri Surveyor

A Quarterly Publication of the
Missouri Society of Professional Surveyors

Jefferson City, Missouri

December 2019

What's in this issue...

CALENDAR OF EVENTS

2020

February 12, 2020
Board Meeting and Legislative Visits
MSPS Office
Jefferson City, MO

April 30 - May 2, 2020
42nd Annual Spring Workshop
Lodge of Four Seasons
Lake Ozark, MO

July 11, 2020
Board Meeting
MSPS Office, Jefferson City, MO

August 12-14, 2020
Review Course
Jefferson City, MO 65101

October 22-24, 2020
63rd Annual Meeting and Convention
Oasis Hotel and Convention Center
Springfield, MO

December 5, 2020
Board Meeting
MSPS Office
Jefferson City, MO

Front Cover: Osage Treaty Line, Milepost 218/219 in the NW ¼ of 27-15-30; about 2 miles northeast of the town of West Fork, Arkansas and 8 miles South of Fayetteville, Arkansas; 35°57' 00.8"N 94° 09' 39.49"W. Photographed by Joe Clayton October 26, 2019.
Back Cover: Osage Treaty Line, Milepost 53/54 in the NW ¼ of 30-42-29; about 9 miles east & 2 miles north of Adrian, Missouri; 38° 25' 10.20" N 94°10' 35.03" W. Photographed by Joe Clayton October 19, 2019.

Donald R. Martin, Editor

Notes from the Editor's Desk

Donald R. Martin

Welcome readers to the December 2019 Edition of *Missouri Surveyor*. This version of the newsletter comes along during quite a transitional season – there is much that goes on. Our ol' pard Tripod the three-legged ground hog has had a busy time. There was catching up on the Annual Meeting news, passing out candy to trick-or-treaters, staying underground during deer season, giving thanks, and making out his Christmas gift list. Not to mention compiling *Missouri Surveyor*! Yes, the humble woodchuck has been on the go, and with that, here we go with this iteration of our interesting, informative and intelligent issuance of illuminating items and instructions for our interrelated ilk. It's invigorating!

First up is Susanne Daniel and her *President's Message*. Madam President delivers a wonderful piece on educating surveying students which concludes with her invitation to readers to join MSPS's Education Committee. Read the message and answer her call! Ms. Daniel's message is followed by another masterpiece of Missouri's surveying history during the transition period of France's Province of Louisiana become the United States' Louisiana Territory by Steven Weible. Mr. Weible is a fine researcher and author that frequently shares his talents and insights with *Missouri Surveyor* readers. In this edition he brings us *Silas Bent: Principal Deputy Surveyor*. Thank you once again Steve. Next up I offer *Surveying Career Awareness Hits the Press*, a review two surveyors and their outreach to local media in the never-ending quest for attracting surveying's next generation. The team from the Missouri Land Survey Program is the following post and they offer a report of 2019 "improvements" to their mission. They offer this news in *A Note from the Missouri Department of Agriculture's Land Survey Program* as well as inviting readers and customers to provide feedback on their service.

Starting on page 17 is a very important article…a must "read." *Update on Missouri's State Plane Coordinate System of 2022* comes to us from State Land Surveyor Ron Heimbaugh. Check it out for the latest on the impending changes coming to our geospatial reference frames. Ron's important technical news is followed by MSPS's news of important honors with *Missouri Society of Professional Surveyors 2019 Awards*. Here the Society features our 2019 Surveyor of the Year recipient, our Robert E. Myers Service Award Honoree and our Legislative Appreciation Award. You'll have to read it to get their names! Next, we offer a photo montage in honor of those sponsoring much that took place at the *Annual Meeting with Thank You to Our Exhibitors*. After the picture page we have a tech tools feature in *Easing Data Frustrations: 8 best practices for survey businesses to optimize software capabilities* from Skopliak and Lemmon.

Friends, as I close my note for this edition, our Thanksgiving holiday approaches. As we offer prayers of thanks and recognize our blessings, may we all be given mercy and renew an abiding hope for peace in this time and forever. Take care readers and my fellow surveyors. We will be back together in late winter.

Donald

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President's Message

Susanne Daniel

Greetings fellow members of the Missouri surveying community, it is an honor to be serving as the MSPS president and I am grateful for the excellent leadership of our former presidents. Looking back on the list of past presidents, I see mentors, role models and resources when we need help and guidance. I would like to thank our newest past president, Chris Wickern, and each of our past leaders for their years of service and dedication to MSPS. I would also like to thank all who have served this past year on the board as well as those who have volunteered time to chair or serve on a committee. If you are not currently serving on a committee, I would like to invite you to consider doing so. Some of our committees have suffered from not enough participants to conduct business without first recruiting or enlisting members. I'm looking forward to having "all volunteer" committees this year so please consider signing up, your time and efforts will be richly rewarded.

Our 62nd Annual Meeting in Columbia was a success; topics were well chosen and very interesting. I particularly enjoyed attempting to predict the outcome of the federal court cases. The information from that session is linked on the MSPS website for your review. During Friday's business meeting, several concerns were mentioned, including national reciprocity in licensing and a suggestion of creating different levels of certification. These topics brought many reasoned emotional responses but there just wasn't enough time in the business meeting format to hold debate. Yet if we don't address these issues and others, we will find that some other entity has taken the liberty of doing this on our behalf and our concerns may not be properly addressed. We can be swept along or we can control the current. It is up to us to set our level of involvement.

During the conference, a group of surveying educators and interested parties, chaired by Dr. Elgin, met to address the future of surveying courses available to students in our state. Currently, some programs offer a combination of pre-recorded lectures with a proctored lab class. Some programs offer a pre-recorded lecture and privately proctored lab class where the student attends lab on Saturday and completes several lab assignments throughout the day. Some programs offer pre-recorded lectures and the opportunity for students to find a local surveyor willing to supervise lab projects. Some programs still offer a live lecture and regular lab class. With so many options, taking the classes should not be terribly difficult. As an instructor for the live lecture, regular lab combination, I can see advantages and disadvantages to the different coursework delivery options.

My lecture class meets on Monday evenings for two hours. Each week, we go over the previous week's homework and answer questions. I pass out the next homework assignment and the current week's lab project and try to explain each. But since both assignments are just being handed out, students haven't

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President's Message *(continued)*

had an opportunity to read them and don't really have procedural questions yet. The typical questions are usually related to how many people will be working together on a team for lab, where will we be working and how long do we have to finish? As far as trying to explain how things will work, I might as well be a puppy performing tricks for the class. Without having their hands on the equipment, they do not truly understand what they will be doing.

After discussing the current homework and lab project, I follow up with the scheduled lecture topics. But, this is a two hour class which unfortunately meets during dinner. After covering homework and the lab project, many students "sneak out" to catch dinner before their dining hall stops serving. I have developed the "missing man quiz" and I don't make enough copies for everyone in the class. When the number of students remaining equals the number of copies of the quiz, I present it, disrupting the lecture portion of class but rewarding students for staying. The problem is that students are missing lecture time. Maybe a pre-recorded lecture that students could access outside of class would be beneficial.

Lab on the other hand is an opportunity for students to take on challenges and work as a team. My students have actually developed friendships and "hang out" outside of class. Since many of these students have other classes together, they have formed study groups and consult upper classmen within the group on homework for those classes as well. This comradery is what makes surveying class fun for them. I find that listening to teams interact can be quite entertaining. After every group in my Tuesday lab class started a project by making the same mistake because nobody in their group actually read the instructions, I suggested that they were using the "lemming approach" to problem solving. While helping one team that was struggling with a resection challenge and a truck that had just parked online, I explained that occupying a known station and turning in the new point was a "preferred approach" to establishing a new control point (this was clearly explained in the unread instructions for the assignment). While patiently allowing the team review the outlined procedure, I overheard one of the members of that team call their rodman on his cell phone, "Lemming leader to lemming rover, we have a bogey! Abort! Repeat, abort! Return to base for new instructions." Yes, they were enjoying field surveying! The challenge is encouraging students to read the assignment. They usually figure things out rather quickly so they don't bother with instructions.

Are students who complete the labs on their own with the supervision of a licensed surveyor at a disadvantage by not working together as a team? What about the student who attends lab on Saturday and is pressured to complete as many labs as possible in a single day? Is the learning process being overly supervised or too rushed? I believe that my students are learning a lot by being allowed to make mistakes and correct them. While I want students to read the assignment, I do not want them to mindlessly "cook book" a surveying procedure. Are students learning what equipment is best suited for a project or are they only learning how to operate a specific instrument? Are students learning a specific method of solving a problem or are we teaching them that there are several ways to solve the problem and allowing them to use a method they deem most efficient?

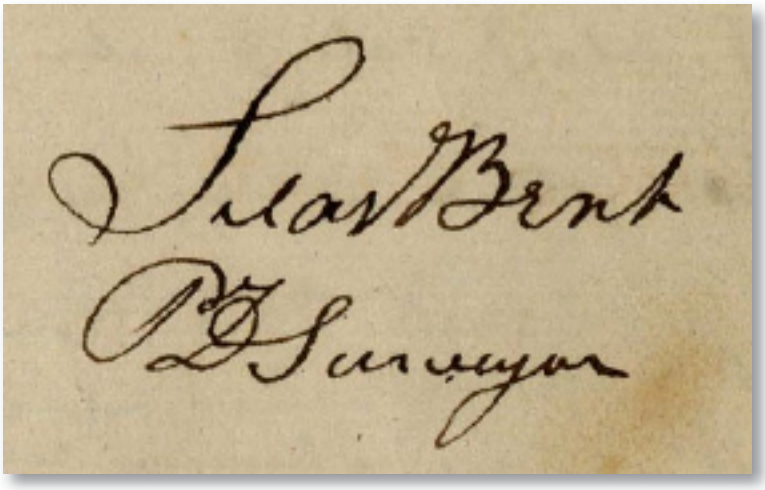
What we should be asking is which methods of instruction will draw more interest in our profession and encourage students to pursue licensing. We have engineering students that are taking the class to meet education requirements, not pursue a license in surveying. We need these engineering students to take our surveying classes. Without them we don't have enough surveying students for our universities to continue offering the classes. Some of these students will change their majors before completing their engineering degree and some will graduate but never spend another day in the field. But most of these students will complete their program and, if we don't drive them away, some may find their real passion is to become both engineers and surveyors. How do we sell our profession to our current and future students? This is the greatest challenge of our profession. Please consider joining the education committee where these topics and others will be addressed.

Susanne

Silas Bent: Principal Deputy Surveyor

Part One

by Steven E. Weible, PLS October 2019



Article II of the Treaty Between the United States of America and the French Republic, dated April 30, 1803, provided that, "*the archives, papers, and documents, relative to the domain and sovereignty of Louisiana, and its dependences, will be left in the possession of the commissaries of the United States*" (U.S. Statutes at Large, Vol. 8, pg 200). Spain, however, not being a party to the agreement between the United States and the French Republic, apparently, did not feel compelled to relinquish the records in its possession. As a result, some officers of the Spanish government caused records to be removed from the Province of Louisiana, depriving the United States of the information contained within them (*Territorial Papers*, Vol. 13, pg 432).

Because of this infidelity on the part of some of the Spanish officials, the United States Secretary of the Treasury, Albert Gallatin, was very concerned about the Archive of Surveys that was still in the custody of Antoine Soulard, the former Surveyor General of the Spanish Province of Upper Louisiana. Mr. Gallatin urgently wanted to replace Soulard and to recover the records in his possession (*Territorial Papers*, Vol. 13, pg 432-435).

After the United States had taken possession of Upper Louisiana on March 10, 1804, Captain Amos Stoddard, exercising the functions of civil commandant, chose to retain Soulard as the temporary depository of the Survey Archives (*Territorial Papers*, Vol. 13, pg 533 & Vol. 14, pg 32). William Henry Harrison, governor of the Indiana Territory, had subsequently commissioned Soulard in October 1804 to continue in the capacity of Surveyor General for the district of Louisiana (*Territorial Papers*, Vol. 13, pg 71, 81). General James Wilkinson, who had become governor of the Territory of Louisiana in July 1805 (*Territorial Papers*, Vol. 13, pg 98), chose to continue Soulard in the office to which he had been appointed by Governor Harrison (*Territorial Papers*, Vol. 13, pg 175), so that Soulard continued in possession of the Survey Archives.

Meanwhile, the Board of Commissioners for ascertaining and adjusting land titles that was assembled in accordance with the act of March 2, 1805, chapter 26, had commenced their work in December 1805. Within months several issues pertaining to surveys were identified that needed legislative attention. First, the act of March 26, 1804, chapter 38, prohibited surveys from being performed, while the act of March 2, 1805, chapter 26, required a plat to be filed with the recorder of land titles. What if a survey had not yet been performed, so that none could be filed with the recorder of land titles? Next, the Recorder of Land Titles, James L. Donaldson, had refused to accept surveys performed by private surveyors, believing that the fourth section of the act of March 2, 1805, chapter 26, required a plat prepared by a duly appointed officer (*Territorial Papers*, Vol. 13, pg 497-498). Governor Wilkinson had in fact issued a proclamation on November 4, 1805, prohibiting surveys by anyone but those authorized by the Surveyor General of the Territory (*Territorial Papers*, Vol. 13, pg 264). Were private surveys to be accepted or not? It was anticipated that surveys would be needed, but who was the proper person to perform them? (*Territorial Papers*, Vol. 13, pg 432-435).

In response to these concerns Congress passed the act of February 28, 1806, chapter 11, *An Act extending the powers of the Surveyor-general to the territory of Louisiana; and for other purposes* (U.S. Statutes at Large, Vol. 2, pg 352). This act

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Silas Bent: Principal Deputy Surveyor *(continued)*

provided for a principal deputy surveyor to reside in the territory of Louisiana and to operate under the superintendence of the surveyor-general of the United States, who was then in Ohio. The principal deputy surveyor was to execute, or cause to be executed by deputies, surveys as may be authorized by law or as requested by the Board of Commissioners. He was also to take possession of all of the records of the Surveyor General of the Spanish Province of Upper Louisiana. The Board of Commissioners was authorized to request surveys as they deemed necessary for the purpose of deciding upon claims before them. Any such survey was considered a private survey only and a re-survey under the authority of the surveyor-general would be required, if the claim was confirmed. The Act also repealed the requirement of a plat of survey as evidence, if a survey had not been performed before December 20, 1803.

Compensation was to be paid for surveys actually run, an amount not to exceed 3 dollars per mile. The principal deputy surveyor was also entitled to receive a fee for examining and recording surveys performed by deputies and for providing a certified copy of any plot of survey in his office. Those fees were 25 cents for every mile of boundary for examination and recording and 25 cents for each certified copy. While the bill for this act was being considered by the U.S. Senate, an amendment was added to provide a salary for the principal deputy surveyor. The amendment, however, was rejected and the act was passed without it (*Territorial Papers*, Vol. 13, pg 448; Senate Journal, Vol. 4, pg 38, 45).

In a letter, dated March 25, 1806, Mr. Gallatin urged Jared Mansfield, Surveyor General of the United States, to immediately appoint a principal deputy surveyor for the Territory of Louisiana. Mr. Gallatin wanted the new appointee to proceed to St. Louis without delay so as to recover the records from Antoine Soulard as soon as possible (*Territorial Papers*, Vol. 13, pg 461).

In a letter to the Board of Commissioners of the same date, Mr. Gallatin informed them that as a result of the recent act a plat of survey was no longer required, if a tract had not been surveyed under the authority of the proper Spanish Officer before December 20, 1803. He also advised them that they were authorized to direct the principal deputy surveyor to perform any surveys that they deemed necessary in order to complete their business. He cautioned them, however, to request surveys only when necessary so as not to harass the claimants with repeated surveys. Also, since any surveys that had already been done and any surveys to be done by the principal deputy surveyor were to be considered private surveys subject to resurvey, it did not matter whether a previous survey was performed under the authority of the proper Spanish Officer or by a private surveyor (*Territorial Papers*, Vol. 13, pg 460).

Jared Mansfield responded to Mr. Gallatin on June 14, 1806, expressing his intent to appoint Silas Bent of Belprie, Washington County, Ohio as principal deputy surveyor for the Territory of Louisiana. Mr. Bent had previously been employed by Mansfield in surveying the public lands and was serving as a judge of the Court of Common Pleas in the county of his residence (*Territorial Papers*, Vol. 13, pg 519). Mr. Gallatin responded on July 3, 1806, approving the appointment and expressing dissatisfaction that his directive had not been carried out immediately upon receipt (*Territorial Papers*, Vol. 13, pg 536).

Silas Bent reported to Jared Mansfield in a letter, dated September 22, 1806, that he had arrived in St. Louis on September 17 and had visited Antoine Soulard to recover the records that had been in his possession. Soulard had been ordered on May 3, 1806 by Governor Wilkinson to cease operation as Surveyor General of the Territory of Louisiana (ASP:PL, Vol. 8, pg 866) and had already surrendered the records to the Board of Commissioners. Bent next visited the Board of Commissioners, advised them of his office and requested that the appropriate records be delivered to him. At the leisure of the Board and their clerk the records were eventually released to him, but no requests for surveys were forthcoming. This put Mr. Bent in a difficult position, since his compensation relied upon requests for surveys from the Board of Commissioners. The Board of Commissioners, however, had been cautioned by Mr. Gallatin to request them only when

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Silas Bent: Principal Deputy Surveyor *(continued)*

necessary. Mr. Bent concluded his letter of September 22, 1806 to Jared Mansfield with the statement that "*This afords but a dark prospect for the present support of my young family in this most expensive Country*" (*Territorial Papers*, Vol. 14, pg 8).

Silas Bent wrote to Jared Mansfield again on September 28, 1806, reporting that "*Nothing relative to my Official duties has taken place since I wrote You – Judge Lucas wishes resurveys made and a general investigation, but the other Commissioners pass the Business over*" *(Territorial Papers*, Vol. 14, pg 12). In a letter, dated October 13, 1806, he further stated to Jared Mansfield that "*I have had no Business for which the Law entitles me to a single Cent and have no prospect of any – I do not know what to do in this unfortunate situation – my children remain unwell* " (*Territorial Papers*, Vol. 14, pg 14).

By late October 1806 James L. Donaldson, the Recorder of Land Titles, had left the Territory (*Territorial Papers*, Vol. 14, pg 21, 27, 64). Following his departure, the remaining commissioners, Judge John B. C. Lucas and Clement B. Penrose, received new instructions from the Secretary of the Treasury that would necessitate a revision of nearly all of the decisions that had already been made (*Territorial Papers*, Vol. 14, pg 19). As a result of these circumstances, the Board of Commissioners essentially ceased operation until they received further direction from the Secretary as to how to proceed (*Territorial Papers*, Vol. 14, pg 27, 36, 40).

Jared Mansfield attempted to intercede on Mr. Bent's behalf by informing Mr. Gallatin of the circumstances in letters, dated October 16, 1806, October 30, 1806 and November 1, 1806 (*Territorial Papers*, Vol. 14, pg 15, 22, 25). He even advocated for Mr. Bent to the President of the United States in a letter, dated October 31, 1806 (*Territorial Papers*, Vol. 14, pg 23).

William Carr, the agent for the United States in the Territory of Louisiana, also chipped in his comments to Mr. Gallatin in a letter, dated November 20, 1806, in which he observed that "*If the power of the surveyor general is by law to be extended to this territory; a principal deputy surveyor appointed, who by his instructions is urged in the most pressing manner to repair immediately to St. Louis, to open and keep, an office there; & the Commissioners are not to continue their sessions, this act of Congress will remain inefficient and without execution – This principal deputy Surveyor, as an officer of the government certainly could not be expected to remove his family to this place; open an office and Continue it here entirely at his own expence; & that too for the expectation of obtaining the compensation allowed by law, whenever it should please the board of commissioners, to afford him any employment – which compensation will be found upon reflection and examination not to be half equivalent to the expences attendant on the discharge of the duties assigned him by Law. More especially in this country where the Tracts of land to be surveyed are scattered over the whole face of the territory and many of them situated at a great distance from the surveyor's place of residence; where no travelling expences to and from the land to be surveyed are allowed and where labour and expences of every kind are excessively high*" (*Territorial Papers*, Vol. 14, pg 36).

In a letter to Jared Mansfield, dated December 9, 1806, Silas Bent remained hopeful that appropriate intervention would "*perhaps turn what has been unfavorable hitherto, very much to my advantage in the end* " (*Territorial Papers*, Vol. 14, pg 51).

SOURCES

American State Papers: Public Lands (ASP:PL)
The Territorial Papers of the United States, compiled by Clarence Edwin Carter, 1948
U. S. Statutes at Large

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Surveying Career Awareness Hits the Press

by Don Martin, PLS

It is an overriding topic of much of "our" conversation. By "our" I mean the surveying community. And the topic? The matter of attracting the next generation of surveyors to the profession. We talk about it at conferences, we talk about it a board meetings, we talk about in surveying newsletters and publications. It is natural that we do so because we see and understand the challenge intimately. But in doing so, we are broaching the dialog with others within the community. To breach the *awareness gap* that exist for surveying as a profession and service this news needs to be shared beyond our community. Two recent articles in mainstream newspapers may serve as examples of reaching beyond our ranks. These are models of closing the *awareness gap* and sharing with the world the fine opportunities which exist in the profession of surveying.

Jeff Gutierrez, a surveyor and business owner in California's San Joaquin Valley penned an article featured in the *Bakersfield Californian* this summer. His firm, DeWalt Corporation, is a well-regarded surveying, engineering and planning practice in Bakersfield. As the company's owner, Jeff knows too well the challenge of finding and hiring technicians. He is the author of *Land Surveying: Best Kept STEM Occupation Secret* which ran in the *Californian* on July 15, 2019. Across the country, a similar story made the pages of *New Hampshire Union Leader* this past spring. In *Surveying: A Great Career Choice with a Very Bright Future* the fun and interesting elements of surveying are detailed in a manner to appeal to young readers or their parents. This feature was written by Michael Carter, the Director of 3D Mapping for Doucet Survey LLC of Newmarket, New Hampshire.

Way Out West

The journey to having an article published in the paper began with two otherwise disconnected events for Jeff Gutierrez. One was his participation in a meeting which included surveyors familiar with the registration boards and surveyor licensing examinations in California and Nevada. As they shared familiar news of low passing rates and low applicant numbers, Jeff was alerted when one of the Nevada surveyors reported they licensed but one (1) new surveyor n a recent testing cycle in Nevada. One! With that stark reality weighing on his mind, Gutierrez found himself having lunch with an editor from the *Kern Business Journal*. Among their meal time chatter, the surveyor shared some of his concerns for his chosen profession with the newspaperman. As Jeff lamented the modest levels of awareness people have about surveying, the editor suggested "write and article." These two prompts got it started.

Not wanting to rely on anecdote and personal opinion Gutierrez undertook a serious study of the problems associated to replenishing the surveying ranks of California. He turned to the California Land Surveyors Association, the Geomatics professors at California State University in Fresno, and the California Department of Consumer Affairs. Reflecting information from all of these sources, Jeff crafted an article which speaks to three primary topics; demographics, education and "selling land surveying."

Jeff Gutierrez, Dewalt Corporation

The demographics he found through research reflected what is well known throughout the surveying world – the professional ranks for surveying are aging and retiring while we are not backfilling career entry. This perception is supported by "… 2016 the U.S. Bureau of Labor and Statistics reported that of the approximately 65,000 land surveyors in the country, only 9,000 were under age 34." Gutierrez also cited how "…NCEES reported in 2016, the average age of a licensed land surveyor is between 58 and 60 years of age." The author most effectively summarized the problems these shifts cause when he wrote "Over the next 10 years … all of those 57 year old surveyors become 67 year old surveyors. I would say that yesterday was the day to hit the panic button." He's right!

As the author looked to the education side of surveying awareness, the news did not get better. Although his state has the benefit of multiple institutions with coursework offerings in surveying, low levels of student awareness of this field are evident in the small class rosters for surveying. Consider what he found at the flagship surveying program at CSU-Fresno. The major is supported by the university administration with help from many surveying and engineering firms in the state. They even make generous scholarship contributions. The program's graduates have a 100% placement rate. Yet, there are about 40 students in their classes each year, usually fewer than ten graduates, and many of the scholarship dollars go unused.

Addressing the need to "sell" surveying, Gutierrez reviewed the National Society of Professional Surveyors recognition of the need through the creation of a Public Relations Award. The submittals for various states which shared the focus of spreading awareness of surveying as an "occupational path" to students and young people. The author specifically cited the program of the Texas Society of Professional Surveyors. The TSPS program supplies school counselors with posters and leaflets which promote surveying as a "viable and profitable career."

From Back East

Whereas *Land Surveying: Best Kept STEM Occupation Secret* closes with the call for "selling land surveying," Michael Carter's *Surveying: A Great Career Choice with a Very Bright Future* is all about the sell. This author describes surveying in exciting, dynamic terms which translates the action of surveying into story. In fact, readers may be a bit winded after reading it, but they will assuredly be interested.

Carter creates a virtual showcase of surveying which features the information age applications of measuring yet harkens to the time-honored truths of surveying in terms of history, procedure and law. He does by emoting action within the three areas of tools, tech and terrain.

After an out-of-the-gate blast generating a milieu of science, exploration and adventure Michael first offers relevant descriptions of surveying *tools* for prospects. Offered as additions to the perception of surveyors standing by tripods with transits, the author supplies their connection to 3D scanners. It is a quick and accurate treatise on the links to clients such as building owners and architect. If that doesn't spark modern techster's interest Carter goes on to the RC part of surveying by revealing the measurement activities supported by UAV mounted systems and the serving as data collection platforms. It is tool operation 101, and it is the type of information which resonates with modern career seekers.

Michael Carter, Doucet Survey LLC

From the hands-on, Carter takes readers to the *tech* and it is game on for the Xbox side of surveying. Enthusiastically offering the constant updating of software as a plus he points out that surveying technology is subjected to ongoing innovation and advancements. That is interesting! It is all about *modeling*, making *reality* and providing *virtual* as the reader is all but invited to put on a 3D headset and commence a walk through/drive through of a project site from the written page. And it closes with the reminder that "Surveyors play a crucial role in making that possible."

Carter closes the triumvirate of topics by touching on *terrain*, not in the form of ground, but in the setting, the place where surveyors work. He shares that universally liked element cited by so many who have plied the trade of surveying. It is the mix of field and office! Evoking the outdoors side of the business in the form of a hike, the article prods readers to don waders, board a kayak and map the world. Then it is off to the archival treasure hunts of ancient records scribed by hand in historic eras. It is the surveyor as superhero and it is enticing! What young reader or parent wouldn't be inspired to investigate this study and vocational opportunity the author aptly describes as "off the radar screen."

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Surveying Career Awareness Hits the Press *(continued)*

Michael Carter gave a very fine interpretation of surveying with language which will engage those seeking work in an endeavor offering fun demands to body and mind. While offering the details throughout the piece, he closes in the sincerest of ways by assure those pursuing that a career in surveying will be "enjoyable." It is a nice touch.

Takeaways

Both articles serve to address surveying's *awareness gap*. The authors should be commended. And from that which they shared in the pages of their local newspapers, we may takeaway the following as good practices when sharing the news of surveying:

Don't preach to the choir. We already know our problems. Heck, we are a part of them! Besides, it is the world beyond our community walls with which we need increased awareness. And it is beyond our ranks from which we must recruit surveying's next Gen. Look for or make opportunities to participate in the mainstream media. Here is an example – the next time your association holds and annual meeting or workshop, send press releases announcing the event to local television and radio stations.

Also recognize that in today's world, mainstream media is not limited to traditional broadcasters and publishers. Those roles have fallen to *content providers* of their own "news" on Youtube, Reddit and Instagram. The next time a project poses unique or notable circumstances, video it. Or post a photo mosaic online.

Research. Just as Jeff Gutierrez did, find supporting information for the surveying community's perceptions. While researching data for *Land Surveying: Best Kept STEM Occupation Secret* he didn't merely rely on what he heard at a meeting. He went to sources for facts. He reviewed stats from the U.S. Bureau of Labor Statistics. State's have offices charged with maintaining demographic profiles and projections within their borders; check with departments of consumer affairs or economic development.

Active in the monitoring of business matters within most communities is the Chamber of Commerce. Local offices have a steady finger on the pulse of the working environment of the locale they serve. In their dual programs of economic development and community development, information about business and commercial needs for the town or city is collected. They have data to offer.

Another source is education institutions. They have a very real count of how many are interested, how many are learning, and how many are graduating. They also track placement numbers to monitor the effectiveness of their programs in serving to connect candidates with opportunities.

To sell requires marketing. Wanting the world to be more aware of surveying is our desire. We are the sellers of that notion. The successful completion of that sale will meet our needs. But meeting our needs offers little to others. Why should they be interested in surveying as a profession or career?

Within our community we must seek to understand what interests' others, then identify and highlight those things within our discipline. That is marketing; meeting and satisfying customer needs. This is exemplified in Michael Carter's *Surveying: A Great Career Choice with a Very Bright Future* when he appeals to students' and career seekers' desires for adventure, history, science! He goes on to make the connection of those interests being found within a surveying career.

Yes, surveying's depleting ranks are a reality, and retirements do make for replacement opportunities. But those facts in and of themselves appeal to our circumstance. But the fun and joy of surveying's work are appealing to those looking for an engaging career.

(continued on page 14)

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Surveying Career Awareness Hits the Press *(continued)*

Focus on adventure and exploration. Like Bear Bryant said, "It's kind of hard to rally around a math class." Well, it might be kind of hard to lure young peoples' interest with thoughts of angles, distances and coordinates. Yes, these are critical elements in surveying mathematics, but viewed strictly within the realm of computations they don't sound like fun. But offered and then seen as piecing together a puzzle is enticing.

It is not simply a matter of using the right words, it is the connecting of tasks (which may be mundane) to purpose. Said another way, it is a satisfying answer to the youthful contention of "why should I study this? I'll never use it!" In surveying, we use what we study, and it is interesting and fun…it is adventurous and exploratory.

Highlight our tools and technologies. It is a contemporary fact; people rely on digital connections to satisfy many wants and needs. Those they will turn to repeatedly are those they view preferably. They like them. Making such decisions in a career is what today and tomorrow's workers expect.

Surveying equipment and software are the "apps" of this profession. Our replacements expect, like and want apps. This is an endeavor that already uses robots, drones, lasers, satellites…it sells itself! Surveying offers game systems and remote control in the guise of work. Who wouldn't want to do that?

Consider the above as you go about you own outreach efforts. And if you want two good examples, take a look at the work of Jeff Gutierrez and Michael Carter. The articles are available at:

https://www.bakersfield.com/kern-business-journal/land-surveying-best-kept-stem-occupation-secret/article_cae4f9c4-2591-5f44-87c4-c86a6ab3a4d9.html

https://www.unionleader.com/news/business/surveying-a-great-career-choice-with-a-very-bright-future/article_04e80542-e6b1-5a15-8a3c-9a0952040fc6.html

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Land Survey Program

A Note from the Missouri Department of Agriculture's Land Survey Program:

For the past several years, the *Land Survey Program* has encouraged customers and surveyors to complete a customer satisfaction survey. This survey includes a series of questions regarding the services provided by the *Land Survey Program*, as well as a comment section for suggestions. This survey provides valuable feedback to assist us in providing quality service.

Improvements made in 2019:

- The **Land Survey Index** (LSI) and **Corner Master Index** (CMIS) shopping carts are now combined, saving both time and money
- Interagency offices (Missouri state employees) can now order and immediately download documents
- St. Louis "city block searches" are now available from the homepage using "St. Louis City" as the county with no additional search criteria required

Improvements in progress:

- The "Help" file will be revised to include tutorials and screenshots to assist users with the online store
- The *Land Survey Program* homepage will be undergoing design improvements to create a more user-friendly interface

Additionally, we would like to remind you, we accept copies of surveys that are not required to be recorded. Our goal is to preserve documents and provide additional resources in our index. For more information, please contact our office at (573) 368-2300.

Thank you for providing the input needed to continue to improve our program to better serve you. We encourage your continued feedback, and are available at:

Missouri Department of Agriculture
Land Survey Program
1251A Gale Drive
PO Box 937
Rolla, MO 65402-0937
Phone: (573) 368-2300
Email: landsurv@mda.mo.gov

At the Missouri Department of Agriculture, we strive to DO MORE!

Update on Missouri's State Plane Coordinate System of 2022

by Ron Heimbaugh, State Land Surveyor

In 2022, the *Missouri State Plane Coordinate System* is going to change! The current horizontal datum, the North American Datum of 1983 (NAD 83), and vertical datum, the North American Vertical Datum of 1988 (NAVD 88) have shortcomings. "Specifically, NAD 83 is non-geocentric by about 2.2 meters. Secondly, NAVD 88 is both biased (by about one-half meter) and tilted (about 1 meter coast to coast) relative to the best global geoid models available today" (US Department of Commerce). In addition to new horizontal and vertical datums, states will have a new state plane coordinate system, State Plane Coordinate System of 2022 (SPCS2022). This article will focus on options and comparisons regarding SPCS2022, feedback from recent survey questionnaires and upcoming deadlines associated with the design of the new coordinate system.

Effective April 23, 2019, the National Oceanic and Atmospheric Administration (NOAA) National Geodetic Survey (NGS) established the final version of the policy and procedures specific to the SPCS2022. The policy outlines a general overview of the new coordinate system. The procedures provide technical details, as well as the requirements and process for state stakeholders to provide input to NGS on preferences for the new system. The stakeholders in Missouri include: Missouri Department of Agriculture's *Land Survey Program*, Missouri Department of Transportation, Missouri Society of Professional Surveyors, Missouri Director of GIS, state professional engineering societies and universities that perform geospatial education or research.

The new SPCS2022 has some obvious similarities and differences from our existing system. Similarly, the new system will be based on the same reference ellipsoid (GRS 80) and will use the same three conformal projection types (Lambert Conformal Conic, Transverse Mercator and Oblique Mercator). In contrast, the new system will reference the 2022 Terrestrial Reference Frames (TRFs); the zone's parameters will be computed to minimized distortion at the topographic surface where surveying occurs rather than the ellipsoid surface. The new system will also allow for multiple coordinate system layers. Furthermore, the design of the coordinate system has the option to be based on stakeholder input. However, NGS will not act on input from individuals, so it is recommended that interested individuals provide their input through one or more of the stakeholders mentioned above.

As previously mentioned, one major difference with the new SPCS2022 is the option to have multiple layers. NGS will allow up to three layers. This means that Missouri could have up to three different coordinate systems in the same area. Of those three layers, one must be a statewide zone. The statewide zone will be similar to NAD83-UTM Zone 15, with one exception. This zone will be optimized according to topography and population distribution within the state. In addition to the statewide zone, states can have one, two or no additional multiple-zone layers; however, only one multiple-zone layer can cover the entire state. A multiple-zone layer is defined as two or more zones contained entirely within the state. Our current three-zone system would be an example of a multiple-zone layer. NGS will also allow a partial coverage layer; these are typically used in mountainous states. One option not previously allowed by NGS is the use of low distortion projection (LDP) coordinate systems. This system would fall under the multiple-zone layer systems. NGS will not design LDP coordinate systems; however, they do require that the LDP designs comply with the requirements listed in their policy and procedure documents. All of the remaining coordinate system options would be designed by NGS if requested. NGS will also allow the use of Special Purpose zones - a zone that crosses over state boundaries. This type of zone may be beneficial to cities such as St. Louis or Kansas City.

One of the major decisions Missouri will be required to make regarding the new SPC system is to determine which multi-zone layer to use, either the three-zone system or the LDP zone system. NGS's policy and procedures require the following if the three-zone system or the LDP system is requested:

(continued on next page)

Update on Missouri's State Plane Coordinate System of 2022 *(continued)*

Three-zone system

- NGS will design the system
- Linear distortion will be evaluated at the topographic surface (not the reference ellipsoid surface)
- System will be designed based on coverage area and population distribution
- System will be designed to optimize performance in each zone; therefore, not only will the coordinates be different from our current system, but the scale and grid bearing will also be different (basically, a completely different system)
- Linear distortion design will be between ±50 ppm and ±400 ppm

LDP zone system

- States will provide a LDP design for NGS to review and approve
- Linear distortion will be evaluated at the topographic surface
- Zone width shall be a minimum of 50 km (31 miles) if the topographic height range is less than or equal to 250 m (820')
- Zone width shall be a minimum of 10 km (6 miles) if the topographic height range is greater than 250 m (820')
- Linear distortion design shall be less than ±50 ppm (1:20,000)
- All stakeholders must agree to use LDP zones

LDP zones are not new. Several states have previously implemented LDP zones; however, these were not recognized or supported by NGS. Some are single county projections; others are multi-county projections. They have been used in Minnesota and Wisconsin for several years. For instance, in Wisconsin, county coordinate reference systems have been actively used since the 1970s. Figure 1 highlights states that have adopted LDP systems and those that have expressed interest in LDP systems for SPCS2022.

Figure 1. (Courtesy of NGS) States with an existing LDP Coordinate System and States that have expressed interest in LDP Systems for SPCS2022.

When evaluating coordinate systems, it can be beneficial to review the linear distortion statistics from other states currently using an LDP system. Table 1 summarizes the statistics from states that currently have an LDP system in place. Although it is difficult to make an identical comparison based on the varying published statistics, the linear distortion appears to be well below NGS's design requirement (less than ±50 ppm) for the LDP designs for 2022.

State	Number of Zones	Max (PPM)	Min (PPM)	Percentage of State less than 10 (PPM)	Percentage of State less than 20 (PPM)
Kansas	20	26.0	-26.9	68.33%	98.80%
Iowa	14	25.9	-25.9	73.63%	99.61%
Oregon	39	Extreme values greater than +/- 50 ppm			
Indiana	92 (57)*	Max = About 24 ppm, 95% less than 13 ppm, 99% less than 18 ppm			
Nebraska (Trial Basis)	95	7 Zones Extreme Value greater than +/- 25 PPM			
Wisconsin	58	Extreme value is about +/- 50 PPM			
Minnesota	86	If published not known to author			

Table 1. Linear Distortion Criteria of Existing LDP Coordinate Systems
*Indiana has 92 counties and 57 different zone groups (having same set of parameters)

Before evaluating the distortion statistics, it is important to review the linear distortion we have in our existing SPCS 83. Figure 2 is a color-coded map of Missouri depicting the linear distortion for our current system. Table 2 has been included in this article as a reference of comparison between parts per million (ppm) and other common means of expressing linear distortion.

PPM	Ratio	Foot/Mile
5	1:200,000	0.0264
10	1:100,000	0.0528
15	1:66,667	0.0792
20	1:50,000	0.1056
25	1:40,000	0.132
30	1:33,333	0.1584
40	1:25,000	0.2112
50	1:20,000	0.264
100	1:10,000	0.528
200	1:5,000	1.056
300	1:3,333	1.584
400	1:2,500	2.112
500	1:2,500	2.64
1000	1:1,000	5.28

Table 2. Linear Distortion Reference Table

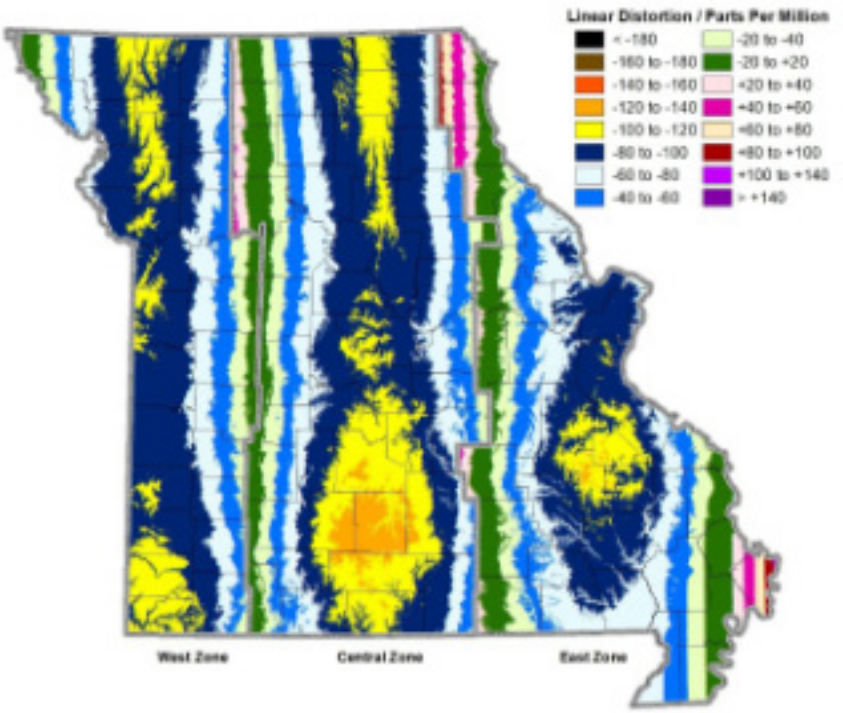

Figure 2. Linear Distortion in Missouri SPCS 83

(continued on page 32)

Missouri Society of Professional Surveyors 2019 Awards

At the 2019 Annual Meeting of the Missouri Society of Professional Surveyors, Awards Committee Chair Gerald Bader led the rank-in-file in recognition of MSPS's "most deserving." To commence the ceremony of honor the Chair guided those present in solemn reverence as all were invited to share a "moment of silence for Mr. [Bob] Myers and the following surveyors who have passed away this past year":

2018: James Charles Wallick
John G. Parson
Jerry Day
2019: Robbie Wayne Neece
Rich Norvell
Daniel M. Ehlmann
Steve Houk
William D. McFarland
Nils Ranum
Chris Stewart
…and Robert E. Myers

Mr. Bader then called upon Dr. Dick Elgin to present the *Robert E. Myers Service Award* to the2019 recipient, Dr. Joseph V.R. Paiva, PS, PE of Kansas City, Missouri:

"*Joseph Vincent Roshan Paiva was born in Sri Lanka. When Joe was 13, his father left Sri Lanka and his family to accept a Fellowship in Boston. Two years later, being on the wrong side of politics and religion in Sri Lanka, Joe's mother sold everything they owned and the [remaining members of the] family left for America to join her husband. They booked passage on a Norwegian freighter and 28 days later Joe, his mother and three siblings got their first glimpse of America as they sailed past the Statue of Liberty into New York Harbor. The family moved to St. Louis where his father was an Assistant Professor at St. Louis University. Joe attended and graduated from St. Louis University High School. The family then moved to New York City where his father worked for the United Nations. Joe attended City College of New York, majoring in civil engineering. The labs for the surveying courses were held in a park in northern Manhattan. The family next moved to Columbia, Missouri where his father was a professor at the University of Missouri. Joe received his Bachelor of Science in Civil Engineering and Master Science in Civil Engineering from Mizzou and taught surveying as a graduate student. He received his PhD from the University of Missouri in 1982. His dissertation title was "Use of the Missouri State Plane Coordinate System," which was supported by the Missouri Land Survey Program. Joe first became involved with MSPS in 1979 when he organized the first Land Surveyors Review Course, held at the Tiger Hotel in Columbia. The course has been taught every year since (42 years) with Joe teaching parts of each session since then. With his PhD, he became an assistant professor in the Department of Civil Engineering at Mizzou. About this time the entire Paiva family became U.S. citizens. In 1985, he moved to Kansas City and joined the Lietz Company, which became Sokkia. He was the principal designer of Sokkia's first data collector, the SDR2, upon which all their subsequent collectors were based. Ten years later he joined Trimble to work in research & product development. He rose to become the Vice President of their Land Survey Division. From 2009 to 2012 he worked for the Belgian firm Gatewing, an early developer of drones for surveying and mapping applications. Trimble bought Gatewing in 2012. Joe is an owner/partner of GeoLearn, an online education company as well as a sister company, Construction Education Associates. While doing this Joe has been busy re-engaging with undergraduate surveying education. He's developed four online courses at State Technical College (Linn, Missouri). He's also taught courses online at other schools including Texas A&M - Corpus Christi and Missouri S & T. Joe has three grown children. One son is a mechanical engineer, the other son is an environmental scientist. His daughter is an Air Force pilot, currently commanding a squadron of KC-135 tankers as a Lt. Commander. Joe looks forward to retirement someday and returning to Sri Lanka to operate an eco-tourism business.*"

Dr. Joseph V.R. Paiva accepts award from Gerald Bader

Bader then moved the ceremony to the presentation of the 2019 Missouri Society of Professional Surveyors recognition of the *Surveyor of the Year…*

"The SURVEYOR OF THE YEAR award has been presented annually to a dedicated member of MSPS since 1987. The recipient is one who gives their time and exudes effort and dedication to land surveying, while working within the society for the betterment of the profession.

"This year's recipient is a second-generation Surveyor. He has contributed to the Missouri Surveyor [newsletter] with the articles; "Who remembers the Golden age of surveying?" and "Direct & Reverse, Surveying?"

"He has presented at several MSPS workshops and Annual Meetings addressing the following topics:

Survey Cost Analysis
Understanding the Boundaries of the Profession
Ethics and the Professional Surveyor
Reading and writing Boundary Descriptions
Safety for Surveyors

"This Member is presently working on revising and updating the Safety Manual for Surveyors, originally prepared by MARLS in 1973

"He currently manages the Surveying Department for Heideman & Associates Inc.

"Licensed in Missouri and Illinois, he has completed surveying related courses at St. Louis Community College, Mineral Area College and the University of Missouri – Rolla [Missouri S & T]. He began his career prior to 1978 working for his father during the summers and on weekends. He has continued in the surveying profession ever since.

"He opened and operated Advance Land Surveyors Inc. in Ste. Genevieve from 1994 to 1999. He has worked in Metro St. Louis, Springfield and the counties of Jefferson, Ste. Genevieve, St. Francois, Franklin and Washington during his 35+ year career.

"The recipient has donated time and effort over the past years with the MSPS Legislative and Standards Committees, believing that "all evil needs to succeed is for the good people to do nothing".

"He serves as Pastor of the Son Light Parish in the Mineral area serving three Presbyterian congregations in the towns of Ironton, Fredericktown and Park Hills.

"He is active in his community serving as President of the Bellew's Creek Watershed Partnership, a group of local folks working to make a difference in the watershed by both cleaning and stabilizing the creek.

"For the years of dedicated service to the surveying profession and MSPS, please help me in congratulating the 2019 Surveyor of the Year, PLS 2437 - Mark Wiley."

Mark Wiley accepts award from Gerald Bader

A "Thank You" from Mr. Wiley –

"Being given the Surveyor of the Year Award was truly one of the most exciting things I've ever experienced in my professional career. Rarely am I speechless, but this honor came very close to doing just that!

"I think it would be remiss of me not to take a moment and thank the Missouri Society of Professional Surveyors for challenging me to become a better professional. These challenges are never easy and at times can leave us walking away from a meeting or event muttering under our breath. If we take these moments for the opportunities they are, learning more about who we are and what we do, it will raise any given individual to a higher standard. I appreciate the opportunities that the Society has given me to work on committees being both teacher and student. While at times I felt like I was in a revolving door, I feel better for having done what I did rather than sitting back and complaining that it was not being done at all.

"In closing I would like to extend a thank you to all of those who have been a mentor, colleague or just someone with a good listening ear to hear my laments.

"Peace to all who struggle with the tasks of our noble Profession. ~ Mark"

(continued on next page)

MSPS 2019 Awards *(continued)*

Awards presentations concluded with the *2019 Legislative Appreciation Award* which MSPS bestowed upon Representation Robert Ross (District 142). Presentation of this award was for his unwavering support and efforts to advance and protect the reputation of the Missouri Professional Land Surveyors and assure accountability in matters of title, land tenure and boundaries.

Born in Houston, Missouri Representative Ross graduated from Summersville High School before matriculating to Southwest Missouri State University where he earned a Bachelor of Science Degree in Cartography with an emphasis in Land Surveying in 2003. He and his wife Chrissy have two boys, Rylan and Carson and they attend the Summersville First Christian Church. In addition to his legislative duties, he is a self-employed Professional Land Surveyor and the owner of *Midwest Benchrest* which is a nationally sanctioned 600- and 1,000-yard shooting range. He served on the Board of Directors of the Missouri Society of Professional Surveyors and is actively involved with Missouri Cattlemen's Association, Texas County Farm Bureau & the NRA. Robert was first elected to the Missouri House of Representatives in 2012.

The following are bills Robert guided through the law-making process which serve the interest of surveying in Missouri.

2013
HB650 – Moved Land Surveyor Program to Department of Agriculture

2014
SB809- Modified various provisions of law regarding the licensing of architects, professional engineers, professional land surveyors, and professional landscape architects.

2015
HB1052 - Added to the description of the practice of a professional land surveyor work which involves creating, preparing, or modifying electronic or computerized data relative to the survey and location of rights-of-way and easements. The survey and location of rights of-way are not exclusive to professional land surveyors unless the survey affects real property rights as defined in current law.

Robert Ross accepts 2019 Legislative Appreciation Award

2016
SB833 - The act specified that provisions of law regarding the practice of land surveying do not preclude the practice of title insurance business or the practice of law.

Former Representative Bart Korman of Warrenton presented Rob with the *Legislative Appreciation Award* and took the opportunity to acknowledge the fine work of Representative Ross. Korman also shared light-hearted tales of legislative trials and tribulations that the two surveyors-turned-politicians shared in their years in "the House." Bart recounted that as next-door neighbors in the chambers of the Capitol, Rob had to go through Bart's office to get to the restroom prompting Korman and Ross to acknowledge the presence of a prescriptive easement for restroom ingress and egress!

Korman called attention to Ross's legislative legacy as one who holds the bureaucrats in Jefferson City accountable. Korman went on to ponder aloud concerns about that which Robert Ross might have done as a bureaucrat himself in his pre-political years with the Land Survey Program. He then regaled the crowd with other suitable names for legislative awards Korman imagined presenting to Ross such as "*The Keeping the Department of Revenue in Line Award*", "*The Keeping Conservation on their Toes Award*" and "*The Aggravating Liberals Award*."

Seminar
The USPLSS for Missouri and for Kansas
March 20, 2020, Kansas City area

Presented by MSPS and the Metro Chapter of the Missouri Society of Professional Surveyors

The USPLSS as applied in Missouri and as applied in Kansas have their differences. This seminar will compare, contrast and cover these differences. The GLO instructions, methods, lotting, protraction and lost corner reestablishment rules for both states will be discussed. Calculation methods (with examples) applicable to each state will be covered.

Examples from Dick's book, "The U.S. Public Land Survey System for Missouri" will be used in this class. (Bring yours or purchase one at the seminar, $75.00.) Kansas examples will also be covered. This seminar is well suited for LSIT's, comity applicants for a Missouri or Kansas PLS license, or PLS's who wish to earn PDU's and expand their knowledge of the USPLSS as applied in the two states. PDU's will be awarded, the number is TBD. For Missouri, 2.0 Missouri Standards Education Credits will be awarded.

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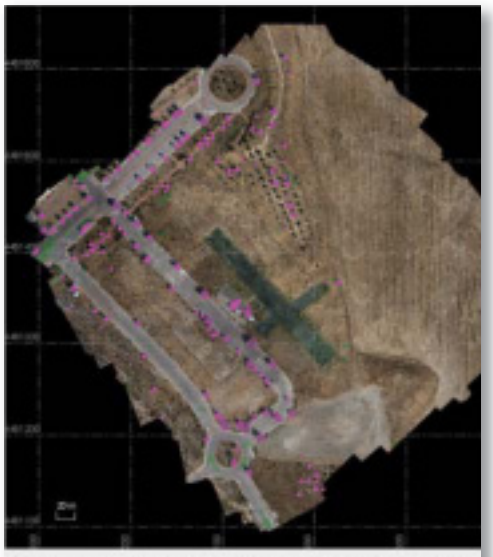
Easing Data Frustrations

8 best practices for survey businesses to optimize software capabilities

by Boris Skopliak, Tim Lemmon

Across the board, software technology is increasingly innovating the way business processes evolve, allowing for greater efficiency and accuracy than ever before.

Surveying industry processes are no exception, with the future trending toward integrated software and collaboration among project teams to extract valuable information from an ever increasing amount of data. The surveyor is now expected to play a key role throughout a project's duration and must be armed with cohesive business software systems that allow performance beyond expectations. The software solutions used by geospatial professionals are often numerous and varied because they are specialized to many different activities, data types and trades. With improved collaboration and open data systems, construction projects can reap the benefits of shared data and reduced rework.



An example of automation, this classified point cloud in Trimble Business Center shows automatically extracted tree features.

Role of the surveyor

Over time, surveying companies have diversified their businesses, and that trend continues. Survey is integral along a project continuum. Even so, clients increasingly own the process and dictate the rules of engagement, with surveyors needing to deliver or risk losing the work to someone else. Surveyors are highly integrated into project teams nowadays, representing both a challenge and an opportunity to grow and deepen relationships with clients. To grow and expand their businesses, surveyors must be pragmatic in choosing the right tools for the job, which often means changing old habits and embracing new opportunities.

An example of data integration, this image shows data captured by the Trimble SX10 containing traditional total station observations, images and point clouds in a single software environment.

With that in mind, let's explore best practices in evaluating and implementing software solutions for survey teams to ensure they are optimizing capabilities to generate core deliverables and unique services with confidence.

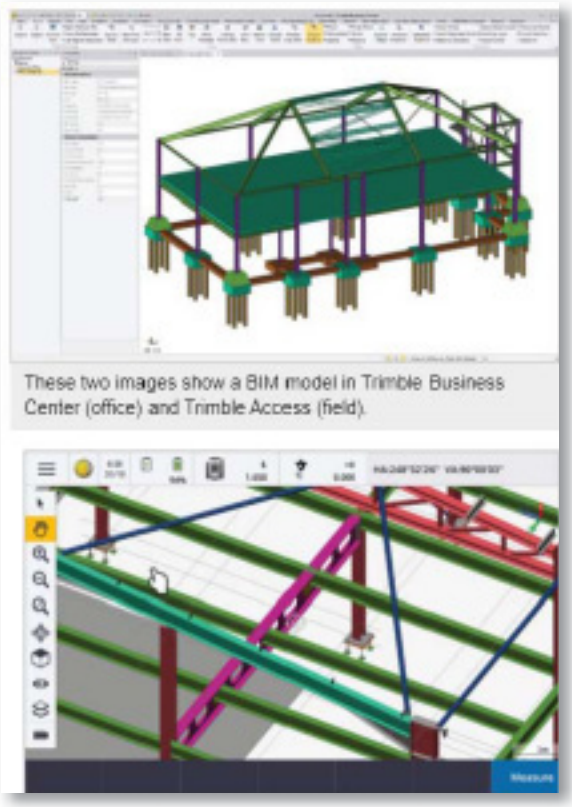
Here are eight actions savvy surveying businesses can take:

1. Be bold and ready to learn.

In a rapidly changing world, the quickest way to learn is to dive right in. With building information modeling (BIM) transforming construction projects today and digital twins and smart cities the view to tomorrow, the adoption of these concepts is still fundamentally based on geospatial information that describes the current state of a physical object or survey techniques to demarcate a virtual object in the real world.

The technology and amount of data used to perform these activities continues to change, but the survey and geospatial principles to ensure accuracy and precise location generally do not change. Your expertise as a geospatial professional is therefore critical to achieve the productivity savings expected by the adoption of BIM, digital twins and smart cities.

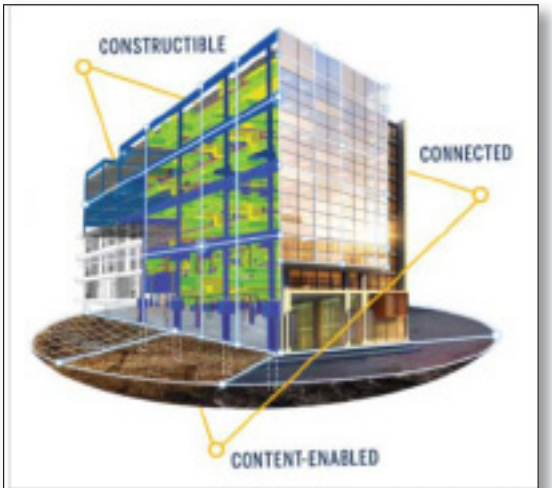
Even so, you will need to learn and adapt so your knowledge provides critical value. Enroll in BIM information sessions, develop connections with industry peers and be bold in bidding for projects adopting BIM methodologies, with the intention to learn. Geospatial leaders are quickly finding their knowledge is more critical than they expected, and solving difficult on-site problems is the quickest way to learn and set themselves up to take on modern projects.



These two images show a BIM model in Trimble Business Center (office) and Trimble Access (field).

2. Designate a software czar or a team of czars.

If you are a sole proprietor, then this is you. Likely, you are very pragmatic about your choices in software and need to carefully weigh the costs of any changes. But if your strategy is to expand, you'll need to evaluate your well-worn paths and consider whether more efficiencies can be gained from different approaches to your software.



From bidding to building and beyond, the construction industry is moving beyond traditional BIM processes to drive more downstream value and better control fabrication and installation in the field. Connected systems to track, store, and display complex data on the fly help deliver valuable, actionable information to all construction stakeholders.

In slightly larger surveying businesses, a designated office professional typically analyzes information and prepares deliverables, while a field person collects the data. Hiring people for these positions who have IT knowledge—IT experts, professionals with dual survey and computer science degrees, or data scientists who are comfortable with cloud platforms and managing large amounts of data— can strengthen the business. These employees often prove invaluable because they know what the company needs to deliver and how to keep technology up to date.

As a best practice, these office professionals should lead continual analysis of new and existing solutions, new integration capabilities, training needs and investments needed to ensure the best mix of software solutions for the business.

3. Consult with an expert.

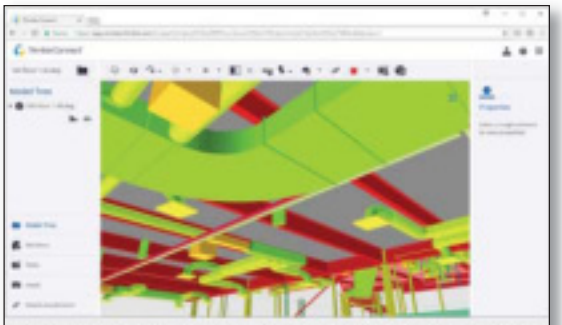
Sometimes you need to step back and seek out expert guidance, but it is hard to know where to find it. A good place to start is your geospatial solutions distributor. Often, distributors will have experts on hand to

(continued on next page)

Easing Data Frustrations *(continued)*

demonstrate new solutions and connect you to existing users. They also are a resource for user forums for asking questions and engaging with others in the profession.

In addition, there are geospatial software consultants who can provide independent analysis of your current field-to-finish setup, explore opportunities and provide implementation recommendations. These professionals take a holistic look at your processes using a digitalization strategy. How do you collect data? How do you transfer it? How do data integration and office validation processes work? And what's the most efficient method to generate final deliverables? Some organizations are getting savvy with these processes and hiring programmers to develop highly efficient, bespoke solutions.



Cloud collaboration solutions like Trimble Connect democratize construction data so a wide range of stakeholders are able to view and consume the current files without the need for specialized software.

4. Consider your data—protect it and choose flexibility to share.

As a geospatial professional you spend endless hours outdoors capturing data that is the foundation for the value you provide clients. Protecting data and client information is essential to protecting your business. Securing your devices, networks and updating software are obvious steps to avoid hacking or infiltration by malware. Backing up data has never been easier by storing across multiple servers or in the cloud.

While you need to protect your data, it's also critical to easily share, move and use your data with a range of different software products or cloud solutions. The adoption of BIM, in particular, is driving the use of rich data throughout the workflow process, demanding the use of more open data standards and improved data interoperability. These changes make it easier to collate data from different sources, track progress, analyze clashes and share information with project stakeholders. Geospatial software is adapting to these needs by ingesting data from multiple sensors, as well as supporting interoperability with industry and open standards or establishing direct connections between systems used to complete a workflow.

Clients can better understand project conditions through shared views of the data like this one using Trimble Clarity.

Trimble Business Center software exemplifies the benefits of data integration and interoperability by providing geospatial professionals with a data hub that's flexible for choosing sensors fit for purpose. Whether GNSS, total station, levelling, lidar, imaging or photogrammetry—it doesn't matter if the data is collected by walking, driving or flying. The result is one software solution for high-accuracy data, CAD deliverables and rich information with full traceability back to the sensor. Trimble Business Center also is increasingly data agnostic, supporting industry standard data types and interoperability with other solutions, including AutoDesk, Bentley and Esri products.

5. Select solutions with automated features.

Tools enabling factual decision-making from big data will be a large focus in geospatial software going forward. We are no longer talking about the collection of big data but the efficient extraction of meaningful information from large amounts of rich 3D scanning and imagery datasets.

However, you need to be selective in picking solutions that offer automatic extraction to ensure they match with your main application. While capabilities are rapidly expanding to support different applications and object types, the

robustness of automatic extraction is the key to productivity savings. If you spend the same amount of time verifying the result of automatic extraction, then it's quicker to extract objects manually. There is no magic "extract my CAD plan" solution available…yet. Software solutions that blend rich data types with existing workflows and automatic or semi-automatic extraction capabilities will provide your business with the greatest efficiency gains.

The focus is also shifting to how companies can do more with their data. With improved data interoperability, professionals farther down the value chain can view, use and share the data to make fast decisions. At the end of the day, you can collect all the data you want, but you also need to know how to make an informed decision with it.

6. Look for customization flexibility.
When selecting software, choose a solution that offers flexibility through customization. Many packages today come with application programming interfaces (APIs), which are really handy if you are integrating workflows with existing business process management software for tasks like invoicing and payroll.

You may find software that does 99% of what you need but is short by one command or operation, and the ability to customize makes it possible to add this functionality. Also look for software that offers extensibility via a macro language such as Python, ArcGIS or Trimble Business Center, or packages that come with well-documented software development kits (SDKs), which allow you to define your own workflows and extend the software capabilities.

(continued on next page)

Easing Data Frustrations *(continued)*

7. Push into the cloud.

Cloud-based products and services are synonymous with global connectivity, information sharing and collaboration. For geospatial professionals, the ability to leverage the cloud for data processing and information extraction can expedite production of final deliverables. Cloud solutions are also proving critical in sharing those deliverables in an open and accessible format—vastly extending the base of potential consumers of that data, and in turn, driving more demand for valuable geospatial information.

Connectivity is a key driver for enabling productivity savings, and the future 5G network will minimize the current limitations of data upload delays and visualization performance, especially with rich 3D point cloud data. Rather than waiting for hours to upload data or shipping a hard drive, geospatial professionals will easily upload and utilize cloud processing solutions across distributed systems to quickly generate results. With the resultant data and information deliverables in the cloud, professionals can take advantage of data sharing and collaboration tools to help clients quickly make informed decisions and maximize the value of their data.

Cloud-based solutions, such as Trimble Connect and Trimble Clarity, provide coordinated construction information for all project stakeholders to share, view, coordinate and comment on visually rich models. Viewers can review the data and collaborate via their web browsers on computers or mobile devices, without compromising integrity, security or performance. The cloud also reduces the burden of the capital expenditures prevalent with traditional office business processes. Gone are the days of purchasing software licenses, setting up large-capacity in-house servers and having an IT team physically touch each computer in the office.

In fact, with cloud-based software, many businesses can forego investing in high-performance office computers by utilizing lower power and lower cost office hardware, including tablets and smartphone devices, to perform the most common tasks. Cloud-based storage provides physical security of the hardware, automatic backups and a strong defense against unauthorized access while allowing organizations to maintain ownership and tight control over their data. The cloud also enables connected worksites, buildings, farms, cities and other projects a fluid transmission of information, avoiding downtime and allowing continuous progress.

8. Take advantage of the as-a-service business model.

The modern surveyor can't do the job today without specialized software, and the software-as-a-service (SaaS) or software subscription model will continue to evolve to support project workflows.

The as-a-service business model is tied to the benefits of the cloud because it allows companies to more efficiently manage each project and reduce operational costs. Organizations pay for only what they use and allocate software costs to a specific project.

Conclusion

Whether you are just beginning your geospatial software journey or have already conducted considerable research, you likely know how critically important it is to ease data frustrations for your business and livelihood.

These trends are certain: The volume of data will continue to increase, technology will continue to evolve, and processes will continue to automate. As a result, project stakeholders will continue to expect more from survey businesses. And as is characteristic of such an exacting profession, surveyors will find new and innovative ways to stay at the forefront of those evolutions.

Boris Skopljak is marketing director, geospatial strategy and analytics, for Trimble.
Tim Lemmon is marketing director, geospatial office software and applications, for Trimble.

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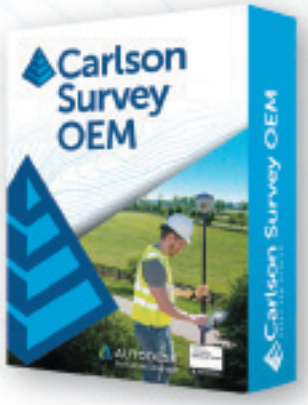

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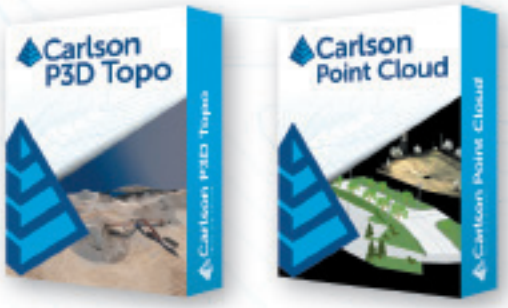

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Update on Missouri's State Plane Coordinate *(continued)*

In order to assist our program, other stakeholders and surveyors in evaluating the best coordinate system for Missouri, the *Land Survey Program* designed a preliminary LDP layout based on NGS's policy and procedures. Although the design is preliminary and may change, the design is close enough to use as a comparison to the other coordinate system options. The preliminary design (Figure 3) is pushing the limits of NGS's design requirements and probably has the maximum number of zones that NGS would allow. In general, the smaller the zone, the less linear distortion. The Land Survey Program compared a portion of the state using the preliminary LDP design to our current systems. In order to make a comparison of coordinate systems, linear distortion statistics were calculated in 78 counties and the City of St. Louis. Figure 4 depicts the areas included in this comparison; statistics were calculated in the pink shaded areas.

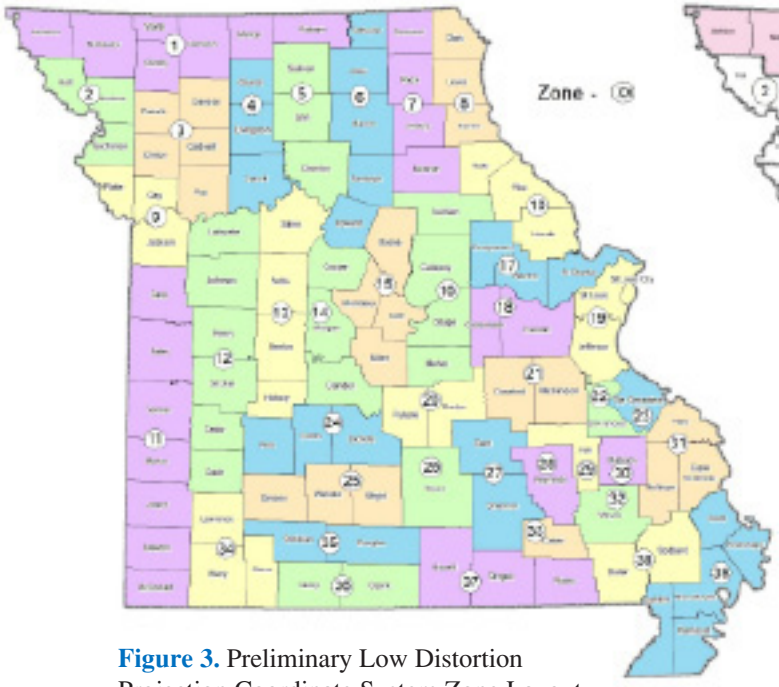

Figure 3. Preliminary Low Distortion Projection Coordinate System Zone Layout

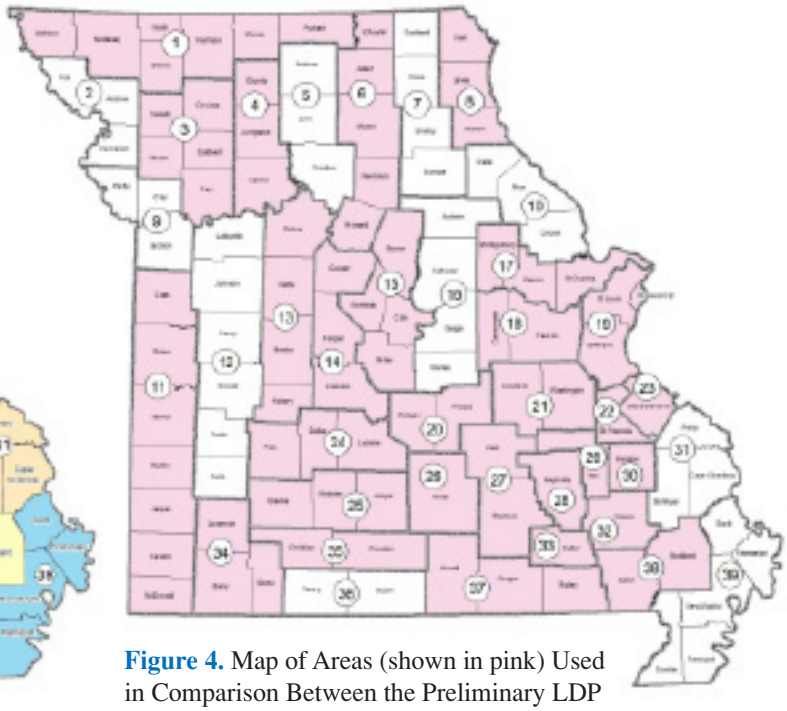

Figure 4. Map of Areas (shown in pink) Used in Comparison Between the Preliminary LDP Design to SPCS 83 and NAD 83-UTM Zone 15.

To make the comparison and a preliminary design, a point coverage of 26.8 million points was created on the entire state on a three arc second grid (roughly 303 feet North-South and 238 feet East-West). The Land Survey Program then computed distortion statistics moving the central meridian or standard parallel on a three arc minute basis, using different scales and projection types. Table 3 summarizes the comparison between our two existing coordinate systems and the preliminary LDP zone system. A good linear distortion benchmark to evaluate the different coordinate systems is +/-20 ppm. The area under +/- 20 ppm for UTM Zone 15 is approximately 2%, 9.39% for SPCS 83 and 99.77% for the preliminary LDP respectively. The preliminary LDP design has substantially less linear distortion than the other two coordinate systems and is the main attraction to this coordinate system option.

Coordinate System	78 Counties and City of St. Louis (Percentage of area under specified linear distortion)					
	+/- 5 ppm	+/- 10 ppm	+/- 15 ppm	+/- 20 ppm	+/- 25 ppm	+/- 30 ppm
NAD 83 UTM Zone 15	0.48%	0.99%	1.49%	1.98%	2.48%	3.00%
SPCS 83	2.02%	4.27%	6.77%	9.39%	11.70%	14.07%
Preliminary LDP System	59.61%	89.02%	97.90%	99.77%	99.95%	99.99%

Table 3. Linear Distortion Comparison Chart

The comparison above uses the current NAD 83 three-zone system but not a three-zone system designed using the 2022 design criteria. How would the current system compare to the 2022 three-zone system? In an effort to compare the current NAD 83 three-zone system to the three-zone system of 2022, the *Land Survey Program* requested preliminary design parameters for the East Zone of Missouri from NGS. The *Land Survey Program* used their preliminary parameters to compare the linear distortion by area to our current East Zone. Table 4 depicts the preliminary results of the East Zone SPCS 83 compared to the East Zone SPCS2022. Table 5 shows the comparison results of NGS's design criteria for the new system which is evaluating the linear distortion compared to the percentage of population, the cities and towns and the overall zone area. In Tables 4and 5, the SPCS2022 three-zone system illustrates an improvement over our current system; however, not enough to eliminate the need to apply scale and elevation factors in most situations.

Coordinate System	Percentage of Area Under Specified Linear Distortion					
	+/- 10 ppm	+/- 20 ppm	+/- 30 ppm	+/- 50 ppm	+/- 75 ppm	+/- 100 ppm
East Zone SPCS 83	8.44%	17.39%	25.82%	40.84%	64.51%	94.42%
Preliminary East Zone SPCS2022	11.81%	24.24%	37.83%	70.18%	94.00%	97.43%

Table 4. Percentage of Area within a Specified Range of Linear Distortion

Coordinate System	Percentage of		
	Population	Cities & Towns	Zone Area
	Within +/- 75 PPM		
East Zone SPCS 83	21%	49%	64%
Preliminary East Zone SPCS2022	99%	97%	94%

Table 5. Comparison of the East Zone SPCS 83 versus East Zone SPCS2022

One of the biggest advantages to using Low Distortion Projections for 2022 is the possibility of eliminating the need to apply scale and elevation factors to measurements in most situations. However, it would still be the responsibility of the professional surveyor to evaluate each survey and to determine if scale and elevation factors are required.

In an effort to inform as many surveyors as possible regarding the upcoming changes, the *Land Survey Program* has given presentations, answered questions and received valuable input from the following organizations:

- June 21, 2018, Southwest Chapter of Missouri Society of Professional Surveyors (MSPS)
- July 13, 2019, Missouri Association of Professional County Surveyors (MAPCS)
- Aug. 27, 2019, Missouri Department of Transportation (MoDOT)
- Sept. 12, 2019, Missouri Society of Professional Surveyors (MSPS) - Standards Committee
- Oct. 4, 2019, Missouri Society of Professional Surveyors (MSPS) - Annual Meeting

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Update on Missouri's State Plane Coordinate *(continued)*

At the MSPS Annual Meeting, the Land Survey Program delivered a presentation titled "Options for a State Plane Coordinate System of 2022." In an effort to determine the preference of the surveyors regarding the new coordinate system, the *Land Survey Program* distributed a questionnaire with the following questions:

1. **Which state plane coordinate multiple-zone layer would you prefer? Low Distortion Projection System or Three-zone System**
2. **Which foot definition should Missouri use with SPCS2022? U.S. Survey foot or International foot**

Of the estimated 250-300 surveyors attending the presentation, 127 questionnaires were returned. 114 voted in favor of the low distortion projection coordinate system on question one and 13 voted in favor of a three-zone system. Regarding question two, 67 votes were in favor of the U.S. Survey foot and 57 votes favored the International foot. The results from this questionnaire reflect the feedback we have received thus far from surveyors and stakeholders that have informed us of their coordinate system preference. To stay on schedule, we hope to receive a response from the remaining stakeholders by the middle of December. Below are the remaining NGS deadlines:

- Requests for zones designed by NGS or proposals for zones designed by stakeholders must be received by NGS no later than March 31, 2020
- For NGS-approved proposed designs by stakeholders, all final defining parameters must
- Confirmation of final design characteristics and computations will be provided by NGS to stakeholders no later than Dec. 31, 2021

The goal of the *Land Survey Program* is to provide information regarding the options for SPCS2022 to Missouri stakeholders and land surveyors in an effort to select the best system for the State of Missouri. For additional information regarding SPCS2022, see the following references and websites:

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National Geodetic Survey

Positioning America for the Future

NGS News & Events

NGS Contributes to Defining a Global Geodetic Reference Frame

Friday August 23, 2019

NGS participated in the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) meeting in New York, New York. This venue also hosted meetings of the UN-GGIM-Americas regional committee and the United Nations Subcommittee on Geodesy. Several decisions were made on how to define a Global Geodetic Reference Frame, and how to implement a Global Geodetic Center of Excellence. Involvement in these international efforts ensures that the U.S. NSRS will align with those of the nations in the region, hemisphere, and globally. As a result, NGS will be better able to assist scientific, engineering, and commercial endeavors for all of the U.S. by aligning all locations to a common and accurate positioning and measuring framework.

Ninth Session of the United Nations Committee of Experts on Global Geospatial Information Management

Software Tool VDatum, Version 4.0, is Released

Friday August 16, 2019

NOS is developing an innovative and evolving software tool called Vertical Datum Transformation, also known as VDatum. Free to the public, VDatum's primary purpose is to convert elevation data from various sources into a common height reference system. Without a common reference system, creating maps and charts from different data sources can introduce inconsistencies. In coastal areas, a shift in elevation on a gently sloping beach might change the overall shoreline delineation, or influence inundation mapping. VDatum coverage is currently complete in all coastal regions of the continental United States, Puerto Rico, and the U.S. Virgin Islands. A Southeast Alaska Regional Model was added in 2019, and future coverage for Hawaii, Alaska, and the Pacific territories will begin after obtaining geodetic and tidal observations. Learn more about VDatum at: https://www.ngs.noaa.gov/corbin/class_description/vdatum/

CST news!

NSPS, October 9, 2019

Through a 2019 Memorandum of Understanding (MOU) with the NSPS Certified Survey Technician Board, the Engineering-Construction Careers Academy in San Antonio, TX began to offer the CST, Level I examination to its students. Below is an article adapted from the Academy's recent newsletter highlighting results from a recent exam.

Students Earn Industry Certification in Surveying

Jonas Marcelle (Senior), pictured with instrument, and Andrew DeLeon (Senior) and Ryan McLaughlin (Junior), second picture, recently earned their Certified Surveying Technician I certification (by exam) sponsored by the National Society of Professional Surveyors. The pair were on the 2nd place SkillsUSA team recently in Corpus Christi as well! This certification means that they are proficient in basic land surveying techniques and are eligible for higher wages as a result. Congratulations!

Jed Lewis is the 2019 National TrigStar Scholarship winner

NSPS, October 2, 2019

Jedidiah Lewis, currently a student at Ferris State University studying survey engineering, was presented the 2019 National TrigStar Scholarship by TrigStar Chairman Jerry Juarez during the NSPS Fall business meetings in Orlando, FL.

NSPS TrigStar Chair Jerry Juarez, Christy Lewis, Jed Lewis, Chris Lewis

NSPS TrigStar Chair Jerry Juarez and Jed Lewis

Jedidiah noted, "I grew up in the Upper Peninsula of Michigan where I spent most of my time hunting and fishing. I graduated high school as Salutatorian of my class, and I have been on the dean's list at Ferris since my first semester. I love being outdoors which is what mainly led me to pursue a career in surveying. Surveying is my passion, and I am eager to spend my career learning all I can about my profession". He was accompanied by his parents Chris and Christy Lewis.

NSPS Board receives government affairs committee update

NSPS, October 2, 2019

NSPS Government Affairs Committee Chairman Pat Smith provided an update to the NSPS Board last week during the Fall Business Meeting in Orlando, Florida. Picture here, Smith highlighted the legislative progress and regulatory state of affairs that NSPS has underway in Congress and in the Executive Branch of the Federal government. Hot button issues included increasing the Federal funding of the U.S. Geological Survey's 3D Elevation Program (3DEP), the House Digital Coast Act was adopted by the House Committee on Natural Resources, and NSPS provided testimony before Congress on several geospatial bills, including the Federal Land Asset Inventory Reform (FLAIR) Act last month among other key issues and developments.

FLAIR Act, geospatial bills get attention in Congress

NSPS, September 26, 2019

NSPS Government Affairs Consultant John Palatiello testified last week before a hearing held the House Subcommittee on Energy and Mineral Resources. Click here for the video. His testimony ranged from the USGS 3D Elevation Program (3DEP) and the 2018 COGO Report Card, to H.R. 4299, the Data Preservation Act of 2019 introduced by Rep. Nydia Velazquez (D-NY), H.R. 2485, the Federal Land Asset Inventory Reform (FLAIR) Act introduced by Rep. Ron Kind (D-WI) and Rep. Bruce Westerman (R-AR), and H.R. 496, the Sinkhole Mapping Act introduced by Rep. Darren Soto (D-FL).

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Big Thanks to Seiler Instruments for sponsoring the Friday night reception at the annual conference

NSPS attends USGS Coalition reception on Capitol Hill

NSPS, September 18, 2019

NSPS Executive Director Curtis Sumner, Government Affairs Consultant John Palatiello, and Federal Lobbyist John "JB" Byrd attended the annual USGS Coalition reception last week at the U.S. Capitol. The event recognized the USGS, the nation's premier natural science agency which conducts vital biological, geological, geographic, and hydrologic research. Senior USGS leaders, as well as representatives of national organizations that use and support USGS science and information, were on hand to discuss the benefits that USGS activities provide for the nation. The 2019 USGS Coalition Leadership Awards were presented to Reps. Derek Kilmer (D-WA) and Rep. Scott Tipton (R-CO) in part for their leadership in support of the USGS 3DEP program, of which NSPS is a strong advocate.

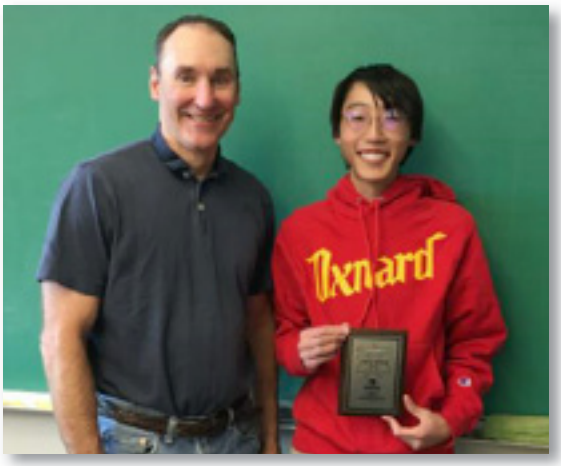
Curt Sumner with USGS leadership

John Palatiello with Rob Gordon, Deputy Assistant Secretary of the Interior.

Trig-Star National winner promoted in local media outlet (Laramie Boomerang)

NSPS, September 4, 2019

Qingfeng Li, who graduated from Laramie High School this spring, has won the national Trig-Star contest, a competition that tests high schoolers on trigonometry. Li was one of 36 state winners to enter into the competition that's run by the National Society of Professional Surveyors (NSPS). Li earned $2,000 for his victory. Laramie High School math teacher Paul Street, who serves as the sponsoring teacher at LHS, also earned $1,000 for Li's score. The Trig-Star test has an hour time limit. Each state's winner is given a second test — this time a little harder — to be submitted into the national competition.



Qingfeng Li, right, and LHS high school teacher Paul Street pose with a plaque earned for Qingfeng Li's victory in this year's Trig-Stars competition.

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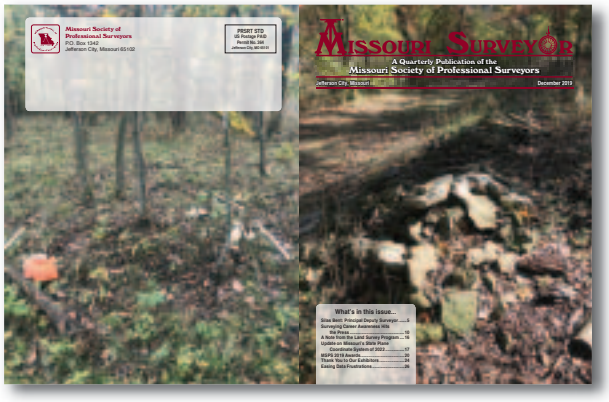

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