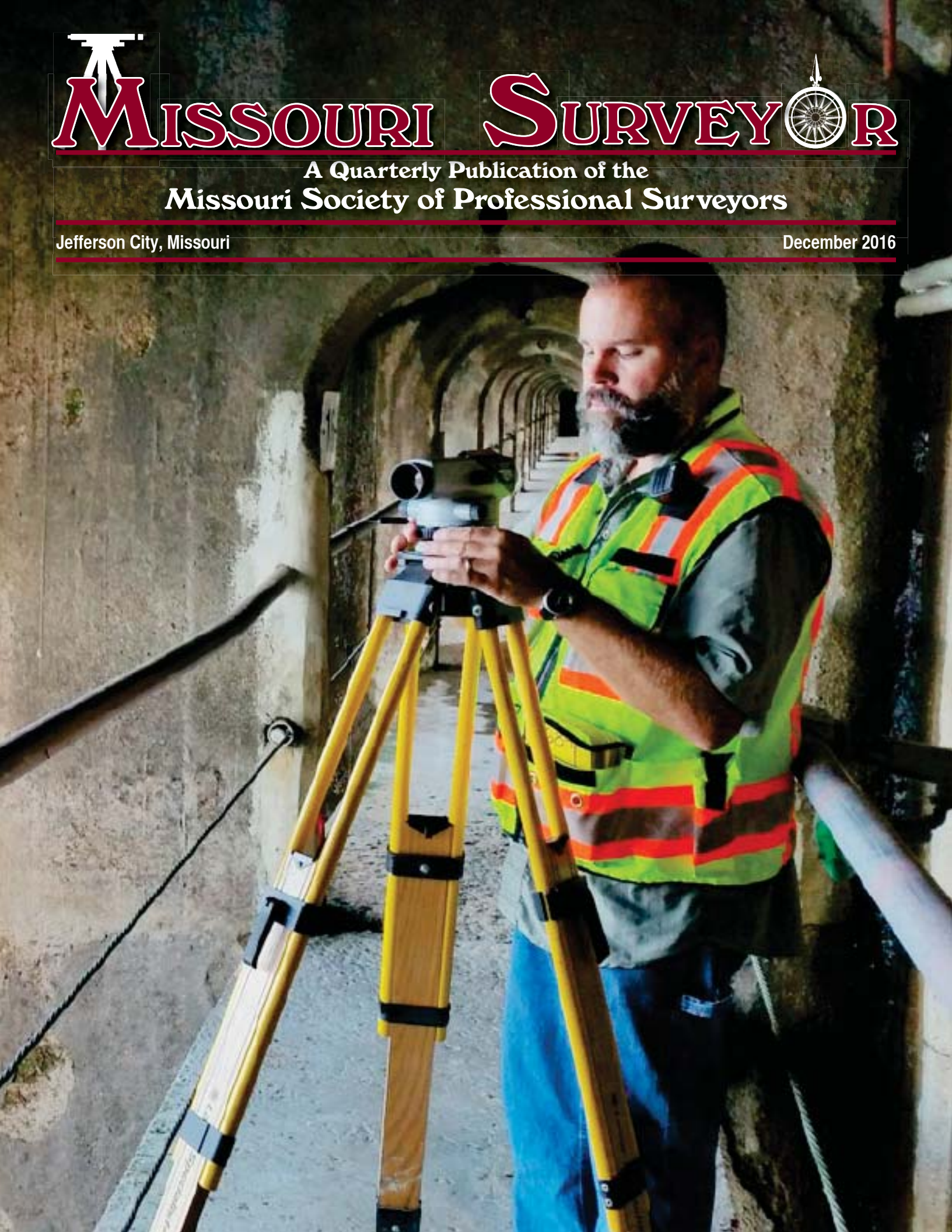


# MISSOURI SURVEYOR

A Quarterly Publication of the  
Missouri Society of Professional Surveyors

Jefferson City, Missouri

December 2016



# MISSOURI SURVEYOR

## CALENDAR OF EVENTS

2017

### February 22, 2017

Board Meeting and Capitol Visitation  
Jefferson City, MO

### April 27-29, 2017

Board Meeting, Golf Tournament and  
39th Annual Spring Workshop  
Lake Ozark, MO

### July 15, 2017

Board Meeting  
Jefferson City, MO

### August 23-25, 2017

Review Course  
Jefferson City, MO

### October 19-21, 2017

60th Annual Meeting and Convention  
Ramada Plaza Hotel & Oasis  
Convention Center, Joplin, MO

### December 2, 2017

Board Meeting  
Jefferson City, MO

### Front cover:

Party Chief Andrew South of Allgeier, Martin and Associates of Joplin is monitoring the horizontal and vertical integrity of the Powersite Dam near Forsyth, Missouri. Initial construction of this dam was completed in 1913 to form Lake Taneycomo. This was the first hydroelectric dam built in Missouri and is still privately owned by the Empire District Electric Company.

Photo by Danny Kibel.

Donald R. Martin, Editor



## Notes from the Editor's Desk

Donald R. Martin




Welcome readers to the December 2016 Edition of *Missouri Surveyor*. This is always a busy time of year for our Newsletter with reports from our Annual Meeting and news from MSPS special events. Certainly the case on both counts this year. Speaking of “busy”, my ol’ pard Tripod the three legged groundhog is making ready for Thanksgiving. Planning a big feast I saw him dragging a big ol’ Cornish Hen into his burrow. He pulled down a couple of tubers so he can have a mashed potato and a candied carrot. With all the kin coming in he’s thinking he’ll bake a cupcake for dessert...promising us all the leftovers! As for me? Well, its time to stop the gossip, get going and grind out the goings-on of our group of gals and guys as well as the goods from other gangs graciously giving to this gazette!

We start with Joe Clayton’s first *President’s Message* – it’s a good read. Our leader’s words are followed by some timely info from the Land Survey Division of the Board of Registration. Reprinted from their

*Dimensions* newsletter we have news from Division Chair *Mike Freeman*, their report on automation of the *PS Exam*, a *License Renewal* reminder and a copy of the statute *327.272 Revision* resulting from 2016 legislation affirming the authority of attorneys and title insurance companies to provide some land description services. Don’t miss a small piece nested among the news from the Division; it’s a request from Dick Elgin seeking your help! He needs your examples of records and projects related to *Riparian Boundary Surveys*. Dick’s request is followed by *News from the National Geodetic Survey*. Our next feature calls for our special thanks to author Mathew Kneeland and editor Carl C. de Baca of *The Nevada Traverse*. They authorized a reprint if Matt’s thesis, *Is Surveying with a UAV Practical?* Before being continued on further pages, the UAV report is interrupted with a photo collage from Abi Padgett illustrating events from the *2016 Annual Meeting* and *Thanks to our Sponsors*. Good job Abi!

The “back section” of the Newsletter brings us recognitions from the Annual Meeting; Dick Elgin being honored as *Surveyor of the Year*, the *Robert E. Myers Service Award* bestowed on Robert Ubben, and a group portrait as a *Welcome to Our New Surveyors*. Next is a photo montage of the *Osage Treaty Line Bicentennial* celebrations sponsored by MSPS and conducted by some of our most dedicated members. Once again History Committee Chair Stan Emerick guided members into further recognition of the surveying contributions to Missouri’s legacy made by Joseph C. Brown. This year’s events were made possible by Stan and fellow historian/surveyors Joe Clayton, Jim Herre, Bob Schotts and Robert Ubben. Along with coordinating venue preparation, press/news dealings, and “getting out the word”, these four also conducted retracements of Brown’s work to establish positions for commemorative stones. Thank you all – MSPS members are proud of and grateful for all you did! Details of the events can be found in the photo captions. Celebration news is followed by a few remembrances. The first is a report from Joe Clayton entitled *Joplin: Five Years Later*. It is a recollection of our December 2011 coverage of the EF-5 tornado which struck that community in May of that year. Ours were stories of devastation, recovery and redemption with a focus on that city’s surveying community. Clayton not only provides a reminder, he shares an update on the subjects of our reports. This edition comes with three solemn remembrances of fallen brethren; obituaries for departed, beloved surveyors *Jeffery Scott Anderson* of Maryville, *Spencer Thomas* of Jefferson City and *Past-President Roy Leimberg* of St. Louis. Their traverse loops are now closed, but memories of them bless and sustain family, friends and fellow LS’s. To close this edition our new President and newest Directors offer *Profiles plus Q & A*; it’s your opportunity to “meet” them and learn about their perspectives on our Society and profession.

Before ending my note I want to thank Andrew, Danny and Monnie for responding to *Be a Magazine Cover Model or News Maker!* Member and reader contributions are always welcome...and desperately needed! Do like these guys and share pictures, news and articles in coming editions. And speaking of coming editions, I better wrap-this-up before its time for the March Edition...I’ll get back with ya’ then... 

Donald

# THE MISSOURI SURVEYOR

Published quarterly by the  
Missouri Society of  
Professional Surveyors

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September Issue — August 1  
December Issue — November 1

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## President's Message

Joe Clayton



Greetings Missouri's surveying community! What an honor it is to be writing to you as President of MSPS. It is an appreciated opportunity and I pledge to honorably guide our society through the coming year. Humbled to follow Jim Mathis (he leaves big shoes to fill) I would like to personally thank him for his services to our profession and our Society... he is a role model for many of us.

Upon undertaking the helm for the coming MSPS year I wish to first reflect on great things this association and its members have accomplished in the past year. Foremost among our events were those honoring our history. Dick Elgin led a gathering at the first USPLSS point set in Missouri on its 200<sup>th</sup> anniversary last December. Then there were two August gatherings recognizing the *Osage Treaty Line Bicentennial*. I would like to thank the many folks that made these events happen by name: Stan Emerick, Dick Elgin, Bob and Delilah Shotts, Robert and Mandy Ubben, Jim Herre, John Briner, Jim Mathis, Robert Ross, Mike Flowers, Aubrey Meyer, Kellan Gregory, Bill Bishop, Jerry Wood, Darrell Pratte, Ron Heimbaugh, Scott Faenger, Jackie Walters, Carol Payne, Anderson Engineering, Affinis Corp and anyone else I may have not mentioned. Good job!

In October many of our members gathered in St. Louis for the *MSPS Annual Meeting*. A wonderful venue, informative workshops, awesome vendor support – we had it all! With many highlights there are of course memories which stand out. Importantly, we proudly recognized our newly licensed Professional Land Surveyors and LISTS...welcome aboard! As they renewed our ranks we also renewed our Society's leadership roles. Congratulations to Ray Riggs and Ron Heimbaugh on becoming our two newest Board of Directors members. As our incumbent Officers ascended to new positions their ranks now include Susanne Daniel, chosen by the rank-and-file to become Secretary Treasurer. Although Mike Gray's directorship was concluded I know we all hope he will continue to share his leadership and legacy with MSPS. I encourage all members to follow these examples and be involved (maybe even nominated). We need you to be our next generation of survey leaders!

The Annual Meeting also had two particularly honorable guests: *NSPS Executive Director Curt Sumner* and *American Surveyor Magazine Editor Marc Cheves*. Curt took time away from his broadcast show to bring us news on surveying issues nationwide and the coming of a new national datum. Marc is one of the unique band of brothers to have served our country as an *82C Field Artillery Surveyor* (as are MSPS members Mike Gray, Chris Wickern, Chuck Quinby, Terry Ross and yours truly). As a fellow Schwabisch Gmund, Germany missile unit *alumni* I would have liked hearing more about Marc's recent trip back there. Paramount in my recollections is another honorable duo; our Award recipients. This year we presented Robert Ubben with the *Robert Myers Service Award* and recognized Dr. Richard Elgin as our *Surveyor of the Year*. Like many of you I respect these two surveyors and treasure them as members and friends.

Winter's cold is upon us, a time I have always preferred for surveying (so long as I didn't freeze to death). It also marks December and early filing of bills for the coming legislative session. Again this year our Society is supporting education legislation. Stay engaged with your local representatives and consider joining our upcoming Capital Visitation Day/Legislative Committee meeting in February, 2017.

I close by wishing everyone the gifts of a Merry Christmas and a Happy New Year! In 2017, please share your gifts and talents with MSPS...join a committee and be an active member.

Joe!

# Professional Land Surveying Division Letter

by Michael C. Freeman, PLS, Division Chair

I hope each of you have had a productive year thus far and that it will continue into the fall and winter. This past legislative season was definitely not a good one for surveyors. Each year it seems like we are losing ground ... we've been unable to push through any increase in educational requirements and have lost ground to the lawyers, utilities and title industry in determining who can write property descriptions. You, as individuals and collectively through MSPS, need to be more vocal ... visit with your legislator and support and defend our profession.

Complaints to the Survey Division were down significantly in the first quarter of the year but seemed to rebound in the second quarter. What was concerning to us was that most of the complaints were not about surveying practice or standards but instead cited unethical behavior by the surveyor. While we believe that most of these complaints are the result of poor communications rather than ethical behavior; others appear to be much more than differences of professional opinion. We want to remind you that your duty is to the public. (20 CSR 2030-2.010(3) states: "...In the performance of professional services, licensees shall be cognizant that their primary responsibility is to the public welfare, and this shall not be compromised by any self interest of the client or the licensee." It is quite evident looking at some of these complaints that the surveyor has become an advocate for the client rather than a finder of facts.

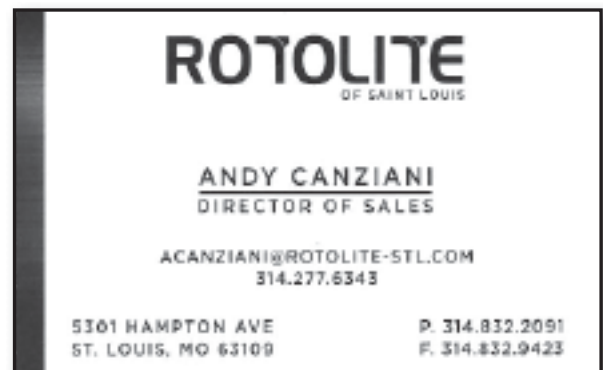
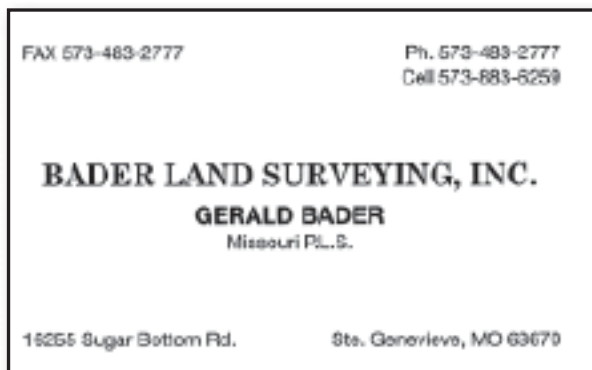
Like previous years, I attended the annual meeting of the National Council of Examiners for Engineers and Surveyors (NCEES). Some meetings are more informative than others. This year there were no new issues. About

the most "exciting" event is the roll-out this fall of the Computer Based Testing (CBT) for the "Principles and Practice" exam. We're looking forward to see how this technology compares to the old "pencil & paper" exams. I expect that it will take a few cycles before we see anything definitive. The Surveyor's Forum generally discusses issues with mobility but this year most of the discussion was on the decline in resident educational programs for surveyors and how we can evaluate and assist these "online" courses by serving as mentors to the surveying student. We need to provide an achievable pathway to licensure by the surveying technician.



The Professional Land Surveying Division began administering the State Specific exam at the Board office on October 19, 2016. At the present time the exam will be given quarterly on a "first-come" basis as seating is limited. We suggest that you plan ahead and get those applications in as soon as possible. 🇺🇸

*Reprinted with permission.*



# Transition of Professional Surveying Exam to Computer-Based Testing

- The April 2016 exam administration was the last PS exam offered in pencil-and-paper format.
- Registration for the computer-based PS exam began in mid-2016.
- The first available appointments for the PS exam in CBT format began October 1, 2016.
- The PS exam will be delivered in the same windows as the FS and FE exams.
- Computer-based PS exams will be administered only at approved Pearson VUE testing centers.
- Candidates for a computer-based exam may take the exam only one time per testing window and no more than three times in a 12-month period.
- Effective with the opening of registration in mid-2016, candidates registering to take the PS exam will be required to pay NCEES directly for all exam-related fees. This will be included as a part of the online registration process.
- The PS exam will have 85 operational (scored) items and 15 pretest (nonscored) items with an appointment time of 7 hours, which will include a tutorial, breaks, the exam, and a brief survey at the conclusion of the exam.
- The PS exam will remain closed-book. An electronic supplied reference will be delivered with the exam. No other reference material will be allowed at the test center.
- Examinees will be allowed to bring and use NCEES-approved calculators on computer-based exams.
- NCEES, has partnered with Pearson to deliver computer-based practice exams. These practice exams simulate the format, style and level of difficulty of the actual exam, providing the most realistic computer-based simulation available and can be purchased at the following link: <http://www.pearsonvue.com/ncees/practicetests/>.



NOTE: The Missouri Specific Land Surveyor Examination will be administered by the Board on the third Wednesday of January, April, July, and October of each year at the Division of Professional Registration Building located at 3605 Missouri Boulevard, Jefferson City, Missouri. It is a two part examination. Passing both parts of the Missouri Specific Examination (as well as passing the required NCEES Fundamentals of Surveying examination and the Principles of Surveying examination) will be required to become licensed as a Professional Land Surveyor in Missouri. Part I and Part 11 of the Missouri Specific Exam are one-hour and fifteen minutes in length each. Both parts of the exam are open-book. You must pass both parts of the Missouri Specific Examination. You may register for one or both parts of an exam administration. Any applicant who fails either Part I or Part 11, or both parts of the examination, must apply to the Board to re-take Part(s) I and/or 11 by completing the “Reexamination/ Rescheduling Application” which can be obtained by accessing the Board’s web site at: <http://pr.mo.gov/boards/apelsla2/apelsla/Re-Exam-Request-LS-MO-Specific.pdf>. 🇺🇸

## HELP WANTED

### Riparian Boundary Survey Examples

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I am writing a monograph about Missouri riparian boundaries (includes littoral boundaries), and I am seeking examples of interesting or puzzling surveys or resurveys of riparian/littoral tracts. Or, boundary descriptions of such tracts which are unusual or vague or conflicting or would be a challenge to survey. Send me deeds or plats or descriptions or questions you may have had about surveying riparian/littoral boundaries.

Thanks for your help  
Dick Elgin

Please send to:

Dick Elgin  
310 East 6th Street  
Rolla, MO 65401

Or email: [elgin@rollanet.org](mailto:elgin@rollanet.org)



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# Important Information Regarding the Renewal of Your License

If you were originally licensed in an EVEN year, you are due to renew your license by December 31st of this year. In fact, you should have already received a “Renewal Notice” around the first part of October reminding you to renew.

Based on renewal statistics collected over the past several years, it has been documented that approximately 80% of our licensees had renewed their license online. Therefore, in an ongoing effort to keep your renewal fee one of the lowest in the nation, we opted this year to send “Renewal Notices” reminding you to renew your license in lieu of the actual paper “Renewal Application.” The “Renewal Notice” provides a PIN number along with instructions on how to renew your license via the Board’s online renewal feature. By renewing online, you are provided with immediate confirmation that your license renewal has been received. It also allows you to pay your renewal fee with a major credit card. Both individuals and corporations can renew online.

Although we strongly encourage you to renew your license online, we realize not everyone has that capability nor is the online renewal feature available for everyone. Online renewals are not available for the following licensees\*:

- Licensees wishing to change their license status from active to inactive.
- Licensees who currently hold an inactive license and wish to return to an active status.
- Licensees who currently hold an inactive license and wish to remain inactive.
- Licensees who will have reached the age of 75 or older.
- Licensees renewing after 11:59 p.m. central standard time on December 31, 2016.

*\*These licensees must complete and submit a paper renewal application. To request a paper renewal application, please call the Board office at (573) 751-0047.*

In closing, we kindly remind you of the following:

- Renewal notices are mailed as a courtesy to all licensees.

- The renewal notice is mailed to your address of record on file at the Board office. If you move, it is your responsibility to notify the Board office of your new address promptly so that we can update your record.
- The Board cannot be responsible for misplaced or mishandled mail.
- Failure to receive a notice for renewal of a license or certificate of authority does not relieve the licensee or certificate holder from their duty to timely renew, nor does it relieve them from the obligation to pay any additional fee(s) necessitated by any late renewal.

It is the licensee’s responsibility to ensure that the renewal application is completed and submitted in a timely manner. The renewal period will end on December 31, 2016. A licensee who fails to renew his/her license by the renewal date shall not practice in Missouri. Licensees practicing in Missouri without a renewed license are subject to disciplinary action by the Board.

If you are not sure when your license expires, you can either call the Board office, visit the Board’s web site and click on “Licensee Search” via <https://renew.pr.mo.gov/licensee-search.asp>, or look at the 5 x 7 certificate sent the last time you renewed-it will display your expiration date.

*NOTE. Section 324.010 - No Delinquent Taxes, Condition for Renewal of Certain Professional Licenses*

*All persons and business entities renewing a license with the Division of Professional Registration are required to have paid all state income taxes and also are required to have filed all necessary state income tax returns for the preceding three years. If you have failed to pay your taxes or have failed to file your tax returns, your license will be subject to immediate suspension within 90 days of being notified by the Missouri Department of Revenue of any delinquency or failure to Me. If your license is suspended for state income tax, you must stop practicing immediately and you cannot return to practice until your license is active again. If you have any questions, you may contact the Department of Revenue at 573-751-7200. 🇺🇸*



## § 327.272 Revision

Note: Due to the passage of SB 833, Section 327.272, RSMo, was revised with the addition of paragraph 5. This revision went into effect on August 28,2016 and is highlighted in blue.

### §327.272. Practice as professional land surveyor defined.

1. A professional land surveyor shall include any person who practices in Missouri as a professional land surveyor who uses the title of “surveyor” alone or in combination with any other word or words including, but not limited to “registered”, “professional” or “land” indicating or implying that the person is or holds himself or herself out to be a professional land surveyor who by word or words, letters, figures, degrees, titles or other descriptions indicates or implies that the person is a professional land surveyor or is willing or able to practice professional land surveying or who renders or offers to render, or holds himself or herself out as willing or able to render, or perform any service or work, the adequate performance of which involves the special knowledge and application of the principles of land surveying mathematics, the related physical and applied sciences, and the relevant requirements of law, all of which are acquired by education, training, experience and examination, that affect real property rights on, under or above the land and which service or work involves:

- (1) The determination, location, relocation, establishment, reestablishment, layout, or retracing of land boundaries and positions of the United States Public Land Survey System;
- (2) The monumentation of land boundaries, land boundary corners and corners of the United States Public Land Survey System;
- (3) The subdivision of land into smaller tracts and preparation of property descriptions;
- (4) The survey and location of rights-of-way and easements;
- (5) Creating, preparing, or modifying electronic or computerized data relative to the performance of the activities in subdivisions (1) to (4) of this subsection;
- (6) Consultation, investigation, design surveys, evaluation, planning, design and execution of surveys;
- (7) The preparation of any drawings showing the shape, location, dimensions or area of tracts of land;

- (8) Monumentation of geodetic control and the determination of their horizontal and vertical positions;
- (9) Establishment of state plane coordinates;
- (10) Topographic surveys and the determination of the horizontal and vertical location of any physical features on, under or above the land;
- (11) The preparation of plats, maps or other drawings showing elevations and the locations of improvements and the measurement and preparation of drawings showing existing improvements after construction;
- (12) Layout of proposed improvements;
- (13) The determination of azimuths by astronomic observations.

2. None of the specific duties listed in subdivisions (4) to (13) of subsection 1 of this section are exclusive to professional land surveyors unless they affect real property rights. For the purposes of this section, the term “real property rights” means a recordable interest in real estate as it affects the location of land boundary lines. The validity of any document prepared between August 27, 2014, and August 28, 2015, by a provider of utility or communications services purporting to affect real property rights shall remain valid and enforceable notwithstanding that any legal description contained therein was not prepared by a professional land surveyor.
3. Professional land surveyors shall be in responsible charge of all drawings, maps, surveys, and other work product that can affect the health, safety, and welfare of the public within their scope of practice.
4. Nothing in this section shall be construed to preclude the practice of architecture or professional engineering or professional landscape architecture as provided in sections 327.091, 327.181, and 327.600.
5. Nothing in this section shall be construed to preclude the practice of title insurance business or the business of title insurance as provided in chapter 381, or to preclude the practice of law or law business as governed by the Missouri supreme court and as provided in chapter 484. ■

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## News from the National Geodetic Survey

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*Thursday, October 20, 2016*

### Geodesy's Role in the National Park Service

NGS's Alaska Regional Geodetic Advisor attended the National Park Service's (NPS) Centennial Science and Stewardship Symposium in Fairbanks, Alaska, to participate in outreach events highlighting the role of geodesy in the NPS. A presentation highlighted the reestablishment of Denali's summit elevation and included posters showcasing progress on the 2016 NOAA Preserve America Project, Technology in the Wilderness. A NOAA/NPS partnership to install new water level stations in Alaska's national parks was also discussed.



*Thursday, October 13, 2016*

### NGS Completes Transition to Regional Geodetic Advisor Program

NGS has completed the transition from a primarily state geodetic advisor program, which covered only 24 participating states, to a new regional advisor program that covers the United States across 14 regions. NGS regional geodetic advisors serve as liaisons between NOAA and its public, academic, and private-sector constituents who manage activities tied to the National Spatial Reference System—the consistent coordinate system that defines latitude, longitude, height, scale, gravity, and orientation throughout the United States.

*Wednesday, October 12, 2016*

### NGS Collects Post-Hurricane Aerial Imagery to Support Emergency Response Efforts

On October 7, NGS began collecting post-Hurricane Matthew aerial oblique imagery along the Atlantic coast from Key Largo, FL. to Cape Henry, VA. By October 12, nearly 5,200 images covering more than 1,200 square miles were collected.

NOAA's mission needs were augmented by requests from FEMA, which is using the imagery to assess damages to infrastructure, property, the environment, and hazards to navigation.

FEMA has also asked NGS to collect imagery of inland riverine flooding and large potential impact areas in Georgia, South Carolina, and North Carolina.

States are using NGS imagery to optimize deployment of emergency services. Since NGS imagery verified where coastal impacts were less than expected, states have been able to divert resources to deal with flooding in hard-hit areas.

All of the imagery collected can be accessed online ([http://storms.ngs.noaa.gov/eri\\_page/index.html](http://storms.ngs.noaa.gov/eri_page/index.html)).

Oblique imagery has the advantage of allowing the team to photograph a wider area, and it improves the visibility of vertical structures, such as the sides of buildings, as opposed to only the tops of buildings as typically seen in traditional imagery. See before-and-after imagery of Kitty Hawk, North Carolina in Figure 1.





**Figure 1**

*Thursday, October 6, 2016*

**NGS Co-Hosts North American Comparison of Absolute Gravimeters**

NGS and the National Institute of Standards and Technology are co-hosting a North American Comparison of Absolute Gravimeters at NOAA's *Table Mountain Gravity Observatory* in Boulder, CO. Twelve gravimeters - instruments that measure the difference in the force of gravity from one place to another - will take measurements in a test designed to identify tiny errors in the measurements and provide valid corrections. The event will include discussions between U.S. and visiting scientists from Canada, Mexico, Italy, Luxembourg, Germany, and the Netherlands.

(continued on next page)

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## News from the National Geodetic Survey *(continued)*

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*Thursday, September 29, 2016*

### **Regional Conference on Coastal Resilience**

The National Geodetic Survey (NGS) and Center for Operational Oceanographic Products and Services (CO-OPS) of NOAA's National Ocean Service, and NOAA's National Weather Service participated in the Hampton Roads Water Symposium hosted by the U.S. Geological Survey and the Hampton Roads Planning District Commission on September 20. The focus was on critical water-related issues, including groundwater dynamics, water quality, best management practices, subsidence, local sea-level rise, and *nuisance flooding*. NGS is working with partners in Hampton Roads on geodetic instrumentation and methodologies to ensure precise and accurate geospatial data to better evaluate coastal resiliency and monitor change under a changing climate.

*Thursday, September 15, 2016*

### **NGS Assists Naval Surface Warfare Center**

NGS is assisting the Naval Surface Warfare Center in Norco, California, by performing absolute gravity measurements to calibrate the facility's manometer (a device used to measure a pressure differential). The Norco facility is one of the U.S. Navy's largest scientific and engineering research and analysis centers. While in Southern California, NGS is also remeasuring existing gravity *monuments* at the NASA Jet Propulsion Laboratory, California Technical Institute, and Mount Wilson Observatory to verify and validate previous gravity measurements.

*Thursday, September 8, 2016*

### **NGS at Geocaching Hampton Roads Mega Event**

At the Geocaching Hampton Roads Mega Event, September 3, in Newport News, VA, NGS educated geocachers on how to help recover survey control marks and provide important documentation for NGS' positional database. Geocaching is a recreational activity of searching for hidden objects using GPS coordinates posted on a website. NGS presented information on field safety recommendations, data submission procedures, and current technology. This event provided an excellent opportunity to increase public awareness of the value of recovering control marks and sharing positional data with NGS, and may provide NGS with updated positional information for upcoming projects in the region.

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*Thursday, August 25, 2016*

### **NGS Collects Great Lakes Imagery**

NGS is continuing an extensive aerial oblique and nadir collection of georeferenced Great Lakes imagery, which began at the beginning of August, but was interrupted to collect emergency response imagery of the Louisiana flood. The Great

(continued on page 14)

# Seiler Instrument

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Over seventy years ago our firm started with optics by servicing and reconditioning surveying instruments and microscopes. Through the years Seiler Instrument focused on expanding this technology to surveyors and many other industry professionals to sell, support, promote, and educate our customers on GNSS/GPS technology, Hydrographic Survey Solutions, 3D Laser Scanning, UAV/UAS technology, CAD software and more.

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Lakes imagery will be used as a baseline to assess hazards to navigation, impacts of future coastal events, and coastal zone management. The imagery will also be used to support mission partners, including other NOAA offices, the U.S. Geological Survey, U.S. Army Corps of Engineers, Federal Emergency Management Agency, and other state, local, and academic interests.

*Thursday, August 18, 2016*

### NGS Collects Aerial Imagery of Louisiana Floods

NGS collected and made available imagery to assist federal, state, and coastal managers in assessing damage from flooding in Louisiana. At the request of the Federal Emergency Management Agency and the National Weather Service, NGS began collecting imagery using coastal mapping and emergency response aircraft on August 14, and will continue to collect imagery weather permitting. More than 2,000 images have been collected to date. NOAA's aerial imagery aids safe navigation and captures damage to coastal areas caused by storms. Aerial imagery is a crucial tool to determine the extent of the damage inflicted by flooding, and to compare baseline coastal areas to assess damages to ports and waterways, coastlines, infrastructure, and communities. The imagery provides a cost-effective way to better understand the damage sustained to both property and the environment. 🇺🇸



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# Is Surveying with a UAV Practical?

by Matthew Kneeland, 2016 Senior Project, Reprinted from *The Nevada Traverse Vol. 43, No. 3, 2016*

## PROBLEM STATEMENT

This project is a comparison of the procedures for field data collection, data processing, deliverable preparation, accuracy, and economic considerations between conventional survey technology and UAV technology for preparation of topographic surveys.

media coverage of the UAV topic, I was able to convince my current employer to purchase a UAV. With access to the technology and skills to competently complete a conventional topographic survey, I expect this project to be of immense value to me on a professional level, peers that have the opportunity to review the work, my employer who has graciously allowed me to utilize equipment and software to complete the project, and any other members of the surveying community that may review these results.

## LITERATURE REVIEW

Extensive testing has been completed for various UAVs by private entities as well as manufacturers. For this project, I am using the Trimble UX5 HP Unmanned Aerial Imaging system, and therefore have referred to results of tests performed by Trimble Navigation to obtain hypothetical estimates of accuracy for this system. According to Dr. Klaas Pauly's whitepaper "Trimble UX5 HP - Increasing Your Productivity", average RMSE errors encountered on a sample of the test projects were: 0.033mX, 0.025mY, and 0.034mZ, for an average horizontal error of 0.071m or 0.233 feet and an average vertical error of 0.067m or 0.219 feet. (Pauly, 2016, p.8). These RMSE errors were obtained using the system with no ground control points but utilizing a post processed kinematic (PPK) trajectory for the flight path. The RMSE seen in Pauly's results correlates to an average of 2.7cm \* ground sample distance (GSD) with no ground control. This is reasonable for many wide area surveys but may not be accurate enough for urban design surveys where new construction will tie into existing features. Secondary processing was completed by Klaas (2016), the same test projects were processed again, this time rather than the PPK trajectory, 9 ground control points were identified for absolute orientation of the flight data. For this processing method the RMSE errors are: 0.026mX, 0.013mY, and 0.058mZ, for an average horizontal error

of 0.048m or 0.16 feet and an average vertical error of 0.114m or 0.373 feet. (Pauly, 2016, p.8). The test project selected was flown at a height of 150m above ground level (AGL) with a 35mm focal length lens. This yields a GSD of 2.4cm. Further testing was performed by Klaas with results varying linearly at

TABLE B.3 COMMON HORIZONTAL ACCURACY CLASSES ACCORDING TO THE NEW STANDARD

Horizontal Accuracy Class RMSE, and RMSE, (cm)	RMSE, (100)	Orthoimage Resale Scanline Maximum Mismatch (cm)	Horizontal Accuracy at the 95% Confidence Level (cm)
0.61	0.9	1.3	1.5
1.25	1.8	2.5	3.1
2.50	3.2	5.0	6.1
5.00	7.1	10.0	12.2
7.50	10.6	15.0	18.4
10.00	14.1	20.0	24.3
12.50	17.7	25.0	30.6
15.00	21.2	30.0	36.7
17.50	24.7	35.0	42.8
20.00	28.3	40.0	49.0
22.50	31.8	45.0	55.1
25.00	35.4	50.0	61.2
27.50	38.9	55.0	67.3
30.00	42.4	60.0	73.4
45.00	63.6	90.0	110.1
60.00	84.9	120.0	146.9
75.00	106.1	150.0	183.6
100.00	141.4	200.0	244.8
150.00	212.1	300.0	367.2
200.00	282.8	400.0	489.5
250.00	353.6	500.0	611.9
300.00	424.3	600.0	734.3
500.00	707.1	1000.0	1231.0
1000.00	1414.2	2000.0	2447.7

As a surveyor, I am inherently interested in technology that makes completing surveying projects faster, easier, or more economical. As an individual, I have always been interested in airplanes and began pursuing a pilot's license when I was 17. I currently hold a Professional Land Surveying license and a FAA Airman's certificate. From this background, it is only natural that I am interested in UAV technology as it applies to land surveying. Given my interest in the technology and recent

TABLE B.7 VERTICAL ACCURACY/QUALITY EXAMPLES FOR DIGITAL ELEVATION DATA

Vertical Accuracy Class	Absolute Accuracy			Relative Accuracy (when applicable)		
	RMSE Van-Vogeland (cm)	95% to 99% Confidence Level (cm)	95% to 99th Percentile (cm)	Within-track Horizontal Reproducibility (Max DHR) (cm)	Track-to-Track/Non-Track (RMSE) (cm)	Track-to-Track/Non-Track (Max DHR) (cm)
1cm	1.0	2.0	3	0.6	0.8	1.6
2.5cm	2.5	4.5	7.5	1.5	2	4
5cm	5.0	9.0	15	3	4	8
10cm	10.0	18.0	30	6	8	16
15cm	15.0	27.0	45	9	12	24
20cm	20.0	36.0	60	12	16	32
30cm	30.0	54.0	90	20	26.7	53.3
60cm	60.0	108.0	180	40	53.3	106.7
100cm	100.0	180.0	300	60	80	160
300cm	300.0	540.0	900	200	266.7	533.3



different ground sample distances, extrapolating this study, expected 3D RMSE error for a mission flown 00m AGL at a GSD of 1.33cm would be: 0.035m, or 0.12'. According to the ASPRS Positional Accuracy Standards for Digital Geospatial Data published in 2015, data collected at a 1.25cm pixel size (the closest class value to the pixel size we are interested in, 1.33cm) and RMSE of 3.5cm would be associated with a Horizontal Accuracy Class of 2.5cm and falls into the accuracy requirements for standard mapping and GIS work (See Figure 1). The Vertical Accuracy Class associated with this expected GSD for non-vegetated areas is 5cm, or 0.16' (See Figure 2). This is as implied earlier, perfectly suitable for wide area collection of topographic data, but for urban design surveys, supplemental data, collected conventionally, would be likely required to ensure accuracy meets the needs of the design team.

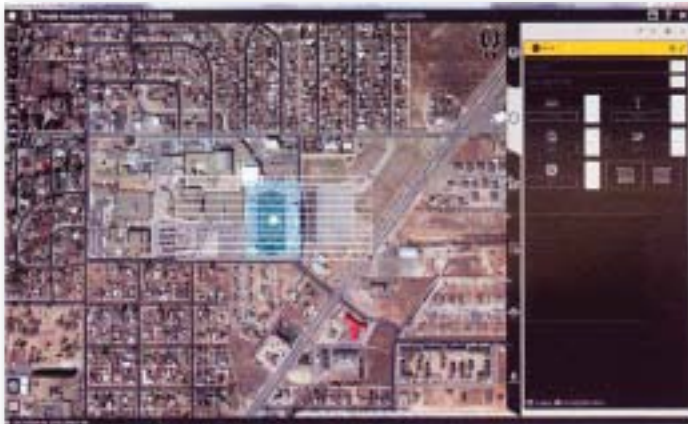
### STUDY AREA

This project will consist of a local high school football stadium. The area covered will be approximately 4.5 acres. This location provides a variety of surfaces, where grade profiles are both sloping and relatively flat. The location also contains significant amounts of planimetric data that can be collected both conventionally and using aerial photogrammetry.



### METHODS

Since the conventional survey methods are not the focus of this project, I will only mention the conventional survey efforts in summary. The intent of the project is



to determine if surveying with a UAV is practical, thus the bulk of our efforts will be directed towards the data collected from that platform, the associated deliverables, and the economic analysis of the two methods. Primary control was established using static GPS methods with Trimble R-10 GNSS receivers and adjusted to NOAA CORS by the least squares method with Trimble Business Center software. A differential leveling network was run using a Trimble DiNi to measure relative orthometric differences between control points. Initially, the project planned indicated panel points should be installed to serve as ground control points (GCP's) but as the project progressed, I determined the panel points were unnecessary since the project area, consisting of a football stadium and running track presented numerous easily visible points that would be collected in the course of the conventional survey. Using the above described primary control network, conventional topographic survey data was collected using a Trimble S-6 Robotic Total Station and a Trimble TSC 3 data collector operating with Trimble Access software.



Following the collection of field data, using a Trimble UX5HP, aerial photogrammetry was collected over the project area. The aerial data collected was processed using the same primary control network and local project settings. Aerial data was collected at 75m AGL using 60% overlap settings and 80% overlap settings, 100m AGL using 80% overlap, and 150m AGL using 90% overlap. Flight planning was completed using Trimble Access Aerial Imaging and the missions were executed on April 2, 2016.

(continued on next page)

# Is Surveying with a UAV Practical? (continued)

The conventional survey data was processed and adjusted in Trimble Business Center software and exported as a CSV points file. The points were imported into Autodesk Civil 3D 2016. Breakline and planimetric data were entered using the points and a DTM surface was created and analyzed in C3D. Aerial photogrammetry was processed in Trimble Business Center.



A photomosaic covering the project area was generated from each flight mission and horizontal control point coordinates were extracted from the photogrammetry. The coordinates acquired from the various flight mission configurations were analyzed in comparison to the accepted control and the results documented. Each data set from the flight configurations was converted to a point cloud using Trimble Business Center and a DTM surface was created from the point cloud. The surfaces created from point clouds were analyzed in comparison to the surface created from conventional data.

Using the selected data set and the conventional data set, Autodesk Civil 3D was utilized to complete two topographic survey plats suitable for delivery to a client.

Manpower efforts and the nature of those efforts (i.e., professional vs. technical) was documented throughout the project and using accepted labor rates, the cost to produce each survey was computed to determine the practicality of using UAV technology from an economic standpoint.

Using RMSE error statistics consistent with the National Standard for Spatial Data Accuracy, the two surveys will be analyzed for accuracy.

## RESULTS

After analysis of the data from the 4 flights it became clear that the data set for the 75m AGL flight was not significantly superior to the 100m AGL flight, although the photomosaic for the 75m AGL flight did show slightly better resolution and associated horizontal accuracy, vertical accuracy actually suffered as a result of flight trajectory not allowing for full 80% overlap in some areas. On the day the missions were conducted, there were winds from the north at about 15mph which could have affected the system's ability to maintain speed and position. In calm conditions, better results may be possible collecting data at 75m AGL. The data from the 150m AGL flight showed significant degradation in both vertical and horizontal accuracy. Given that the 100m flight provided the most usable data (most bang for the buck) in this case, that data set was chosen for the remainder of the project.

## CONVENTIONAL SURVEY

Results for the conventional survey are not discussed in great detail here since that is not the focus of this project. It is assumed for the purpose of this project that field collected data is acceptable for using in preparing

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deliverables. Field data was collected on March 26-27, 2016, using the methods outlined above and standard field data checks consisting of independent verification of 20 points around the project were completed and the field data was found to meet expected accuracy requirements. Manpower/equipment requirements were documented and a summary is shown in the table in Appendix A. Using estimated values for billing, overhead and equipment costs, the total value for the conventional field survey is \$3,979.48. This should be an acceptable number to use as the value for the project and to compare the costs from completing the survey with UAV technology.

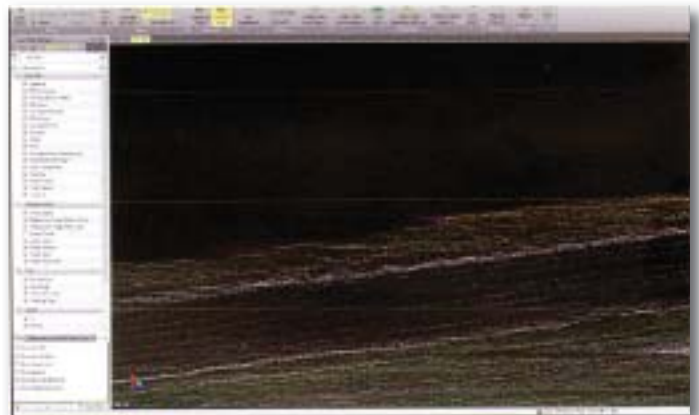
### AERIAL SURVEY

Results from the aerial survey are more interesting: After initially processing the 100m flight data using a PPK trajectory and no ground control points. This project found that using the PPK trajectory resulted in different accuracy when compared to the same data set corrected to ground control. A random selection of 20 points were chosen and extracted from visible features that were also shot conventionally. These 20 points were used to determine horizontal accuracy. A separate 20 random ground shot points were chosen over the project area to test only vertical accuracy. Using NSSDA method for approximating circular error when RMSEX is not equal to RMSEY, which is  $Accuracy = 2.4477 * 0.5 * (RMSEX + RMSEY)$ . Using no GCP's, the average horizontal accuracy for the data set was 0.094m or 0.309 feet. Again using the NSSDA method to calculate vertical accuracy which is:  $Vertical Accuracy = 1.9600 * RMSEZ$ , the average vertical accuracy for the data set without GCP's is 0.149m or 0.489 feet.



Processing the 100m flight data again, but using a total of 8 ground control points which were selected on the ground to control the photogrammetric data yielded slightly better but similar results for horizontal accuracy. Using GCP's, the average horizontal accuracy for the data set was 0.078m or 0.255 feet. Vertically however, a significant improvement in accuracy is seen. The average vertical

accuracy for the data set with GCP's is 0.076m or 0.248 feet.



There are a few interesting/important notes regarding the processing of point cloud data collected from this platform. First, processing photogrammetry is somewhat computing intensive and can take significant time to complete. Although the operator is not required to supervise processing time, it does occupy a computer station. This project took approximately 2 hours on the computer to process and this project had only 92 images. Larger projects with several hundred images will take longer, extrapolating the time for this example, a project with 500 images would take approximately 11 hours to process. This would likely need to be left running overnight to begin analyzing data the next morning. Second, large amounts of useless data are generated in the point cloud. Vegetation, obstructed areas, above ground improvements, and random noise combine to make the initial point cloud all but useless (in terms of terrain modeling) in its raw format. TBC Photogrammetry does have a setting for generating a point cloud intended for use in terrain modeling, which helps, but even with that assistance, significant amounts of unusable data is generated. Approximately the same amount of time that is required for the computer to complete the initial processing is required by an operator to filter the point cloud data. The figure above shows an example of the type of noise encountered in analyzing the point cloud data. In this example, the magenta points near the top of the screen clip are selected for removal.

### ECONOMICS

For the purpose of analyzing the economic aspects of surveying with a UAV, I prepared estimates for labor rates, overhead billing rates, and equipment costs based on my experience and known costs for some equipment. Simply entering those values into the spreadsheets shown in Appendix A, I estimated the unit costs as well as overhead burdened costs for completing a project of this nature conventionally and using a UAV. Conventionally

(continued on page 22)

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## Is Surveying with a UAV Practical? (continued)

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surveying this project, the direct costs to complete this survey would be \$1345, and the burdened cost would be \$3979. Surveying the project using as UAV the estimated direct cost is \$971 and the burdened estimate is \$2998.

### ANALYSIS

With respect to the accuracy achieved using the UAV system, the results seen in this project do not meet the expectations set forth in the manufacturers white papers. Part of the discrepancy may be a marketing aspect in that the manufacturer wants to present the product in the most favorable light. Secondly, this is my first attempt at completing a project with the UAV, I learned many processes that should help to make future projects go smoother and perhaps lead to better results. Additionally, in Pauly (2016), accuracies were measured from photo points selected from image pixels in relation to ground control points (p.5). In this study, I measured accuracy with respect to the actual deliverable surface, not individual photo pixels. This is a more useful measurement of accuracy for a surveyor and may help explain some of the accuracy differences seen between my study results and those of Pauly (2016).

That being said, the vertical accuracies achieved without ground control points are suitable for most surveys with contours displayed on a 1 foot interval. Horizontally, the accuracies were similar for the project with and without ground control points but the ground control points did improve the vertical accuracy of the survey to 0.248 feet. This is well within the tolerances for most survey data. Based on my experience as a surveyor and an engineer, I would feel comfortable using this platform to complete topographic surveys. I would however, choose to supplement the aerial data with conventionally collected measurements at critical locations such as: curb tie-ins, floor elevations, storm drain elevations, utility elevations, etc.

With respect to accuracy, Pauly (2016), states that accuracy of non-GCP controlled flights can be improved by additional flight blocks with a small number of diagonal flight lines across the project area at a higher altitude (p.5). Pauly (2016) indicates that the relatively low flying height combined interferes with observability of the lens focal length (p.5). I did not use this technique with this project. In the future, use of crossing higher flight lines may result in better accuracy.

Economically the results are impressive. Total direct costs, including labor and equipment were 27% less using the UAV than conventionally. As is the case with

most technology in the service industry, it is easy for professionals to allow the value of technology to pass directly to the client. In this case, it probably does not make sense to complete surveys using a UAV at an hourly billing rate with overhead calculated the same way it is for conventional surveys. If a firm instead chooses to serve its clients with value based pricing rather than an hourly rate, it could estimate the actual value of the service, in that case the potential for additional profit is huge. Assuming the value of the survey to be the conventional survey's total overhead burdened billing, there is room for additional profit of \$981, which is a 30% increase over the burdened cost for completing the survey with a UAV. If only one project of this nature were completed per week, it would total to more than \$50,000 in additional profits, this is after overhead for the more expensive labor required and the cost for equipment has been added.

In terms of labor requirements, the use of the UAV does present a few concerns. First, under current FAA regulations, a licensed pilot is required as the pilot-in-command of any commercial UAV mission. Unless the firm already employs a surveyor who is also a licensed pilot, this adds a roughly \$65,000 employee to the firm (Salary.com). Although the direct cost for the pilot is accounted for in my estimates, pilots may not be the easiest to recruit for a surveying firm. The second item to note is that a professional surveyor or photogrammetrist is required for the bulk of the data processing. This will increase the workload of more highly qualified staff than what is required to complete the survey conventionally.

### CONCLUSION

From these results and analysis, I can conclude that surveying with a UAV is not only practical, it has a viable potential to be very profitable. The foremost concern with UAV data is the accuracy, as land surveyors experienced in the 1990's with GPS it can be difficult to adjust to new technology. Especially when that technology has potential for large errors and must be verified with new methods that current surveyors may not be fully competent with. It is almost certain that the surveying community will hear horror stories of how a UAV ruined a project by putting out erroneous data but as with GPS, those stories will come from uneducated and/or untrained surveyors using UAV products outside their practical limitations, and from those who are looking for a magic box solution to make their job easy.

From this analysis, I am confident that while data may not meet the accuracy implied by manufacturers, with training and careful use, the technology can be added to

our toolbox to complete some surveys faster, easier and more profitably, and with sufficient accuracy for the needs of the client. Surveyors who choose to adapt their pricing strategies to take advantage of at least part of the improved efficiency of this new technology will likely obtain the most benefit. However, even if the surveyor chooses to pass the savings on to clients, total costs to complete some surveys can be reduced by more than 20%

The technology will certainly change the skills needed to be competitive as a surveyor and if/until the FAA changes licensing requirements for operating a UAV commercially, additional certified/licensed employees may be needed.

In my opinion, those who wait too long, or refuse to adapt to UAV technology as it pertains to surveying will find themselves trying to catch up to the rest of us in the relatively near future.

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## Dick Elgin – Surveyor of the Year

Each year since 1987, the Surveyor of the Year Award has been presented to a dedicated and accomplished member of MSPS. The recipient is one who upholds the principals of land surveying, while giving their time and efforts to better the land surveying profession through the organization.

This year's recipient was once an editor of the MSPS newsletter and served our Society as President in 1983. He is a former member of the Missouri Board for Architects, Professional Engineers, Professional Land Surveyors and Landscape Architects and is a member of Missouri S&T and the University of Arkansas' Academy of Civil Engineers.

A second generation surveyor, who joined the Army after flunking out of Missouri S&T. Rather than be drafted, he enlisted and completed U.S. Army Helicopter Flight School, was commissioned a Warrant Officer, and spent 1969 in Vietnam flying LOH's and the UH-1 "Huey" with the Americal Division. After completing his Army obligation he was more focused on his education and went on to receive his BS and MS in Civil Engineering from Missouri S&T and his PhD from the University of Arkansas. He is a licensed engineer and land surveyor in several states. In 1984, he purchased the family surveying business which he operated until 2008. He built the business from a relatively small firm into a surveying and mapping company serving federal and state agencies, consulting engineering firms, land developers, lenders and individuals.

Along with colleagues, he developed a series of celestial observation products, the "ASTRO" software, and they wrote the "Celestial Observation Handbook and Ephemeris" which was published by the Sokkia Corporation from 1985-2008. He co-authored "Legal Principles of Boundary Location for Arkansas" and "The U.S. Public Land Survey System for Arkansas." He also wrote the "The U.S. Public Land Survey System for Missouri" along with other numerous articles on technical and professional surveying subjects.

He is an instructor for the Missouri Surveyors Review Course and an Adjunct Professor at S&T, teaching the required and elective courses in surveying. He travels the "seminar circuit" giving professional and technical talks about a variety of surveying topics to surveyor meetings nationwide. Our recipient is an avid collector and researcher of early American surveying equipment, and owns one of the largest private collections of such equipment in the U.S.

Outside of work he enjoys touring by RV, bicycle or in his perfectly restored 1976 Alfa Romeo 1600 GT Junior or 1967 Austin Cooper 1275 S with his wife Becky.

For his dedication to land surveying and MSPS, please help me in congratulating the 2016 Surveyor of the Year, Dr. Richard Lewis (Dick) Elgin.





## Robert Ubben – Robert E. Myers Service Award

The Robert E. Myers Service Award is presented each year to a member of MSPS, who has shown exemplary service and dedication to the surveying profession and to the organization throughout their career. This year's recipient is a very deserving individual who holds his career as a land surveyor in high regards and has persevered to reach the top of his profession.

What is service and what does it mean to you? Service can refer to Military Service or those giving of their time/energies/abilities to protect our country. Service can refer to the serving of a meal. Service can also refer to the volunteering of ones time for the benefit of others. All 3 forms of service have one common thread, the sacrifice of ones times for the benefit of others. When we serve we are putting the needs of others above our own personal needs and desires.

The recipient of this award has served multiple terms for MSPS, volunteering on multiple committees and is a Past President. He has served for the Kansas City Metro Chapter of MSPS and Kansas Society of Land Surveyors. He assisted with the changes within the Land Survey Program, as it became a division of the Missouri Department of Agriculture. Most recently, this person assisted on the 200<sup>th</sup> Anniversary of the Survey of the Osage Treaty Line by locating the northern ties, setting the stone, and meeting with fort staff.

Introducing youth to the profession is a passion of his too. Having mentored younger professionals that are now licensed land surveyors in Kansas and Missouri. Serving as an adjunct professor at Longview Metropolitan Community College in Kansas City, and mentoring high school students at the Blue Valley Center for Advanced Professional Studies.

As an owner and principal of a surveying and engineering firm, he has set an example of servant leadership for his co-workers. His co-workers emulate his example by actively participating in the local chamber of commerce, school districts, professional organizations, leadership groups, and non-profit organizations.

This year's honoree began his career in 1987 working alongside his father and brother. Over the course of his nearly 30 year career he has worked his way through the ranks, so to speak, and has always welcomed new challenges, pushing himself to grow as a land surveyor and becoming an integral part of his company. He received his Professional Survey License in Missouri in 1995 and Kansas in 1997. His co-workers said that he is always willing to make life easier not only for them, but for clients and colleagues and that he lives by the core values of – balance, collaboration, excellence, servant leadership, and trustworthiness.

Outside of work he loves spending time with his family, especially his grandchildren, and is an avid lover of Kansas City Sports.

Ladies and gentlemen, please help me in honoring the exemplary service and dedication of this year's Robert E. Myers Service Award recipient, Professional Land Surveyor, Robert Ubben.



## Welcome to Our New Surveyors



James Barganier, RLS, Thomas Barnard, RLS, Damon Braidlow, LSIT, Jon Brewer, RLS, Michelle Brown, RLS, Jacob Case, RLS, Tony Derboven, RLS, Brent Jorgensen, RLS, Christopher Moore, RLS, Jonathan Rowsell, LSIT, Dustin Shepherd, LSIT, Anne Smoke, RLS, Eric Trentmann, RLS, Colin Zahner, RLS

Not all of them are pictured.

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## Osage Treaty Line Bicentennial

This year marked the 200th anniversary of the survey of the *Osage Treaty Line*. This line was supposed to serve as the western and northern boundaries for the State of Missouri, its location was to be along boundaries negotiated in 1808 between the United States of America and chiefs of the Greater and Little Osage nation. This line represents the very first boundary line actually surveyed in western Missouri.

In celebration of this anniversary, the Missouri Society of Professional Surveyors held two commemorative events in August where replica stones were set and the legacy of surveyor *Joseph C. Brown* was honored. The story of these events is presented in the following collection of photos from the festivities. (*Photos provided by Gerald Bader, Joe Clayton and Robert Ubben.*)



*MSPS President (and Southwest Chapter President) Joe Clayton (center) addresses all gathered at the southern terminus of the Osage Treaty Line near Stark City on August 13th. Behind Joe is the location of a replica stone place as a permanent monument.*

(continued on next page)

### In Memory of Roy E. Leimberg

Leimberg, Roy E. passed peacefully on October 22, 2016, at the age of 79. Survived by Harrison Billy and Carol Leimberg (nee Pelly); children Diane Watson (Steve), Carolyn Rooney (Jim), Robert (Kalen), Marybeth, Kathleen Garazin (Scott); 15 grandchildren, 3 great-grandchildren; brother to Gloria Zacher (Raoul), the late Carl (Annemarie); born to the late Fred W. Leimberg, Jr. and Elizabeth Leimberg-Reeff (nee Brach); nephew to the late Friedel Garza (nee Leimberg). Services: Roy was remembered with a Brunch/Reception on Saturday, November 5, 2016, at the Deutscher Kulturverein Halle, 3652 S. Jefferson Ave., St. Louis, MO 63118. In lieu of flowers, memorials to the St. Louis Family Resource Center is requested. Safe journey my rock and partner. Roy Leimberg was a member for many, many years and served MSPS as president in 1982.



## Osage Treaty Line Bicentennial (continued)



State Representative Robert Ross (right) of the 142<sup>nd</sup> District looks on as his wife Chrissy (left) and their two sons visit with MSPS Past President and Land Survey Registration Board member Mike Flowers at the Fort Osage gate. Many members were joined by family, friends and the Fort's visiting public for the celebration of Joseph C. Brown's survey of the **Osage Treaty Line**.



State Representative, MSPS Member and Professional Land Surveyor Robert Ross (left) presents History Committee Chair Stan Emerick with proclamations from the Missouri Senate and House of Representatives recognized this historic event.



The commemorative "Indian Line" stone is marked on its reverse with the year of Brown's original survey and the bicentennial commemoration year. Now a permanent part of the historic Fort Osage, MSPS members have commissioned a durable placard to be made and placed near the stone to tell the story of the survey of the **Osage Treaty Line**.



MSPS History Committee Chair Stan Emerick (left) commences the festivities at the August 20<sup>th</sup> commemoration of the **Osage Treaty Line Bicentennial**. Hosted at the historic Fort Osage MSPS was graciously helped with this celebration by the Fort's Site Administrator Heather Campbell and her staff.



A commemorative replica stone was set at the northern terminus of the **Osage Treaty Line**, also known as the “Indian Line” as noted on the left face of the monument. Prior to the August event, MSPS members Joe Clayton and Robert Ubben retraced Joseph C. Brown’s 1816 measurements at Fort Osage.



The commemorative replica stones as delivered by the engraver. The southern monument (left) is marked “Osage Treaty Line” while the northern point is labeled as “Indian Line”.



Bruce Burnaugh of Rox Stoneworks in Nixa. An Italian-trained sculptor, Bruce provided the engraving for the commemorative stones.

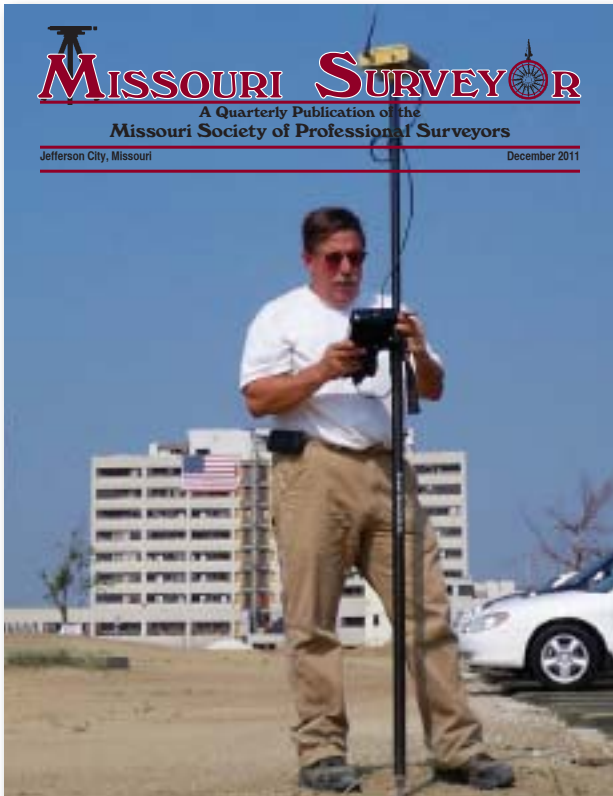


Joe Clayton and MSPS Past President Bob Shotts (left) at the site of Missouri’s southerly Osage Treaty Line point. In the weeks prior to the **Osage Treaty Line Bicentennial**, Bob, Joe and Jim Herre of Joplin retraced Brown’s 1816 survey.

# Joplin: Five Years Later

by Joe Clayton, November, 2016

Five years ago *Missouri Surveyor* reported on the damage caused by the EF-5 tornado that hit Joplin on May 22, 2011, the effect it had on fellow surveyors, and the roles MSPS members played in community restoration.



*December 2011 edition featuring Jim Herre surveying near remains of St. John's Medical Center.*

An immediate impact to our surveying community was the loss of home, business and worldly belongings by MSPS member and local surveyor *Chris Stewart* (Chris Stewart Surveying of Joplin). Chris and Karen Stewart resided in what became the tornado's path. Theirs was a loss of everything but their lives! Like many surveying proprietors, home was where they lived and where they operated a business. Not only lost were memories and personal possessions, lost too was their means of making a living, of surveying. But out of disaster rose hope and help. The Timmons Group, a national civil engineering/geospatial services firm stepped up, stepped in, and donated two trucks loaded with surveying equipment! Already sustained in Faith, our friends Chris and Karen were sustained in the ability to work, to recover. They eventually purchased another home and Chris now works

in association with MJ Surveying of Joplin. And those two "loaded" trucks? Chris's is still in service today. The other one, well...

Another local firm, *Stewart & Neece Surveying* suffered damage to their business as well. Not the total loss as befallen upon Chris, yet substantial and destructive to vehicles and equipment. Having just been blessed by helping hands with our professional community, Chris Stewart "*paid-it-forward*"; he gave the second loaded truck to Stewart & Neese!



*The back cover of our Dec 2011 edition feature this picture of all that remained of Chris Stewart's house and neighborhood.*

Today Rodney Neese reports they are busier than ever, and the little green truck given in charity to help is still in service! Later in 2011, the Neese's were even able to make a vehicle donation of their own!

*(continued on page 32)*



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## Joplin: Five Years Later (continued)

After the initial emergency phase of life in Joplin community leaders began to grapple with matters of long-term recovery. In times like that the need to quickly return a broken community to whole tempts officials with quick-fixes and shortcuts. Such was the case for Joplin officials. With well-meaning desires to help, the City had considered waiving requirements for plot plans necessary for building permits. MSPS's *Southwest Chapter*, under the leadership of Monnie Sears realized the harm to land owners and the land boundary infrastructure of the town embodied by such a proposal. This group of surveyors stepped up, stepped in and preserved the integrity of the land and boundary system throughout Joplin. The intense rebuilding effort to come rested on a foundation of preserved monuments, corners and good land practices.



*Joplin High School after the tornado.*

The intense rebuilding effort became massive! Over 7,000 building permits have been issued with a total construction value of over a billion dollars. Homes, businesses, and

schools have been steadily getting rebuilt and new businesses have come into the area. The tornado took out multiple schools on its 13.1-mile journey. Temporary classrooms allowed classes to begin on time in August of 2011, but it took several years to get new schools built and open. While some education buildings are still being rebuilt, 2014 and 2015 saw the reopening of elementary, middle, and high schools that host thousands of Joplin students. These rebuilding efforts included the services of many from our surveying community. Allgeier, Martin & Associates, Anderson Engineering, Indian Creek Surveying, MJ Surveying, and Tri-State Engineering (div. of Olsson Assoc.) are a few of the local firms and surveyors who have participated in the rebuilding effort.

As much has been rebuilt with the help of surveyors over the past five years, it will still be a long time before the replacement of roughly 7,000 homes is complete. Over 1,800 homes to date, a rate of one house a day! The years to come will see the opening of a new library, university, parks and businesses. Joplin's population has even surpassed the pre storm number. However, damage at such a severe scale takes more than getting back to work. Tens of thousands of volunteers, hundreds of thousands of work hours, and a resilient, determined community has come a long way getting this City back on its feet. The volunteer and community helping efforts have benefited from surveyor leadership too...

MSPS member Jerrod Hogan of Anderson Engineering formed *Rebuild Joplin*, which began as a website connecting those in need with those who wished to help. *Rebuild Joplin* was later reformed as a construction nonprofit, building 181 homes for tornado survivors.

Good job Joplin...and good job, surveyors!



*Rebuilt Joplin High School (right) and new residences (left, including Chris Stewart's neighborhood).*



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## In Memory of Jeffrey Scott Anderson

Jeffrey Scott Anderson, 46, of Maryville, Mo., passed away unexpectedly at his home in Maryville, on Sunday, September 25, 2016.

Jeff was born in Des Moines, Iowa, on May 30, 1970. His parents are Condra Marie (Connie) Ekle Anderson, and Dennis Mathew Anderson. Jeff lived most all his life in Maryville.

He was preceded in death by: his grandparents; and his beloved dog, Molly.

Jeff graduated from Maryville High School in 1989, as class president. He attended NWMSU, and was a member of the Sigma Tau Gamma fraternity.

He worked as a agent for the Soil and Water Conservation (NRCS), at the Maryville office.

He served the Nodaway, Holt, Atchison, and Worth county areas. He also owned and operated True Wheel Cyclery, in Maryville. Jeff had previously worked at Midland Surveying in Maryville.

He was of the Catholic faith. His memberships included the Missouri Association of Land Surveyors, member of the Relay for Life Steering Committee, and a board member of Maryville Parks and Recreation, and he was an avid fly fisherman.

His survivors include: his parents, Connie Anderson, Maryville, and Denny (Rita) Anderson, Maryville; his brothers, Patrick Shawn (Jennifer) Anderson, Ft. Collins, Colorado, and Timothy Shain (Kristen) Anderson, also of Ft. Collins; his former wife, Suzi Schneider-Anderson; his six nieces and nephews, who he loved and was very proud of, Gunnar Anderson, Rider Anderson, Sophia Anderson, Katie Mundo, Sara Mundo, and Anthony Mundo; numerous cousins; and his beloved pets, Missy, and Pickles.

Jeff has been cremated and his memorial service was on October 1, 2016, at the Bram-Danfelt Funeral Home, Maryville.

Jeff had passions for his rescued dogs, cycling, family and friends. He was well loved and will be greatly missed.

The family received friends at the funeral home.

Memorials are suggested to the Cavalier Rescue USA, c/o Carolyn Stickler, 1345 Eagle Run Drive, Sanibel, FL 33957, [www.cavalierrescueusa.org](http://www.cavalierrescueusa.org).



## In Memory of Spencer Thomas

Mr. Spencer Thomas, age 83 years, of Lake Ozark, Mo., a former Jefferson City resident, died Saturday, October 8, 2016 at the Oak Tree Villa Nursing Center.

Spencer was born January 13, 1933 in Jefferson City, Mo. the son of Marvin and Dorothy Rippetto Thomas. He was married on July 2, 1952 in Harrison, Arkansas to Joyce Downing who preceded him in death on November 16, 2002.

A lifelong resident of the Central Missouri area, Spencer was a 1951 graduate of Jefferson City High School, a 1954 graduate of the Jefferson City Junior College, and a 1960 graduate of the International Correspondence School when he became a Registered Professional Engineer in 1960.

He owned and operated P.S. Thomas Land Surveying and Engineering from 1960 until 1977 and was the Cole County Surveyor and Engineer from 1977 until 1986. From 1986 until his retirement in 1997, he was employed as an Engineer and Surveyor with the Missouri Division of Design and Construction.

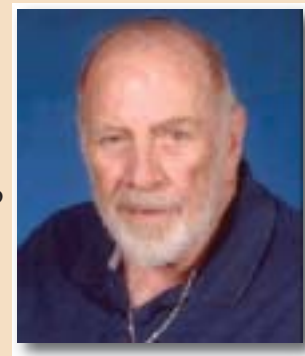
Spencer was a member and chairman of the Property Committee of the Lake Ozark Christian Church; a member of the Missouri Assn. of Land Surveyors; a member of the Missouri Assn. of Professional Engineers; a member of the National Organization of Surveyors and Engineers; served as President of the Harbour Towne Home Assn.; and a member of many recreational clubs.

He enjoyed woodworking, fishing, and reading. Most importantly, he loved spending time with his family and friends. Survivors include: four children, Randy K. Thomas of Jefferson City, Mo., Michelle D. Brown and her husband Dan of Lake Tapawingo, Mo., Matthew P. Thomas and his wife Theresa of Sturgeon, Mo., and Kellye R. Thomas of Columbia, Mo.; nine grandchildren, Sarah Garriott and her husband Chance, Krista Thomas Roberts and her husband Ken, Andrea Skinner and her husband Jon, Kellen Brown, Tyler Thomas, Asher Biggs, Lilianne Biggs, Graceanne Biggs, and Emory Biggs; and eight great-grandchildren.

He was preceded in death by his parents, his wife, and his sister, Bonnie J. Thomas.

Visitation was at Freeman Mortuary in Jefferson City on October 25th followed by a memorial in the Freeman Chapel, Reverend Gary Mitchell officiated. Internment was at Woodcrest Primitive Baptist Church in Ashland, Missouri.

In lieu of flowers, memorial contributions are suggested to the Lake Ozark Christian Church.



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## Missouri Surveyor Profile: New MSPS President Joe Clayton

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At the Annual Meeting of the Missouri Society of Professional Surveyors Joe Clayton was installed as President. A proud 8<sup>th</sup> generation son of Missouri Joe is also the President of the MSPS Southwest Chapter. After a long career with MoDOT and the Missouri Department of Conservation he practices with Anderson Engineering of Joplin.



Joe is a graduate of the University of Wyoming Land Survey Program and a “survivor” of the U.S. Army Field Artillery Survey School.

*(Mo Surveyor) What inspires you to serve as President of MSPS?*

**(JC)** The chance to serve as an inspiration to others who would like to step forward and offer their voices to the leadership of our profession; **if I can do it so can they.**

*(Mo Surveyor) What does leadership mean to you?*

**(JC)** Getting people to follow you by their own choice, not by force. Being at the front of the room not the back; you can't lead from the back. Leading also means being willing to be advised as needed, someone is always willing to advise!

*(Mo Surveyor) What issues are the most important for MSPS to address?*

**(JC)** Lagging numbers of new people entering the profession! We in the profession seem to have no clear sense for a solution. The need for survey services is outpacing our recruitment.

*(Mo Surveyor) What is the most important quality for an association president to have?*

**(JC)** Humility; the term in office is for one year and the charge is to get the Society to next year.

*(Mo Surveyor) What do you consider your most important contribution to MSPS?*

**(JC)** Being involved, whether chairing a committee, showing up to board meetings, testifying in the House and Senate or organizing events. I am dedicated to the fellowship of this honorable profession.

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## Missouri Surveyor Profile: New MSPS Director Ron Heimbaugh

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At the Annual Meeting of the Missouri Society of Professional Surveyors Ron Heimbaugh was installed as Director. He is the Field Surveys Section Chief in the Missouri Department of Agriculture's Land Survey Program where he oversees cadastral and geodetic projects and coordinates County Surveyor and Surveyor Co-op programs.



Ron earned a BS in Industrial Technology for the College of the Ozarks and has worked in civil engineering and surveying for more than 25 years including work as a private section project manager with firms in the Rolla vicinity.

*(Mo Surveyor) What inspires you to serve on the Board of Directors of MSPS?*

**(RH)** Serving on the Board of Directors will give me the opportunity to give back to the profession that I have found both

*(continued on page 40)*



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## Missouri Surveyor Profile: (continued)

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challenging and rewarding for the past 27 years. I also believe serving on the Board is an excellent opportunity to work with other surveyors to collectively strive toward advancing our profession.

*(Mo Surveyor) What issues are the most important for MSPS to address?*

**(RH)** Important issues for MSPS to address are the lack of interest from young people in the surveying profession and the low LSIT and PLS exam pass rates. Addressing these current challenges will require promoting the emerging technologies in the Land Surveying profession while still preserving the traditional aspects of surveying within the educational *curricula*. Drawing technology oriented students of today by providing a combination of education, technological advances and work experience is essential in preparing prospective surveyors to succeed in this profession.

*(Mo Surveyor) What do you think is the most important quality a board should have?*

**(RH)** There are several important qualities an effective board should possess, but maintaining balance is one of the most important. It is important that a board consists of a balance of members with diverse experience in various areas of the profession and different points of view to assist in problem solving. An effective board must balance respect for individual opinions, it must balance serving the profession and providing leadership, and it must balance preserving the history of the profession while envisioning the future of the profession.

*(Mo Surveyor) What is the most important quality for a board member to have?*

**(RH)** I believe the most important quality for a board member to have is integrity. In order to effectively work with others, members must be honest and fair, they must comply with moral and ethical principles, and they must respect and trust each other to represent the best interest of the profession.

*(Mo Surveyor) What do you consider your most important contribution to MSPS?*

**(RH)** As a new Director, I hope to utilize the experience and knowledge I have obtained in both private practice and in public service to effectively serve the board and the members of this organization.

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## Missouri Surveyor Profile: New MSPS Director Ray Riggs

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At the Annual Meeting of the Missouri Society of Professional Surveyors Ray Riggs was installed as Director. He entered the surveying world upon his 1982 graduation from West Plains High School and became a part of Riggs & Associates, Inc in 1989. Licensed in Missouri as a professional surveyor in 2003 he has since added licenses from Oklahoma and Mississippi to his professional pedigree.

Ray is a devoted servant to his Lord, an active member of Junction Hill Pentecostal Church and an ordained minister within the Ozark Pentecostal Holiness Fellowship. Along with joyful commitments to faith and family, Ray maintains an interesting and entertaining blog, *bigsurveyor.blogspot.com*.



*(Mo Surveyor) What inspires you to serve on the Board of Directors of MSPS?*

**(RR)** When you have been affiliated with MSPS as long as I have, you have seen many great men and women “come up through the ranks” to sit on the Board of Directors. The professionalism and uniqueness of these individuals is an inspiration to me.



*(Mo Surveyor) What issues are the most important for MSPS to address?*

**(RR)** For the past several years, MSPS has been grappling with the issue of Education Requirements. To increase or not to increase? Since I obtained my license with required coursework (U of Wyoming and U of Maine) and many years of experience, I may have a different view on this issue. Hand in hand with this is the proactive promotion of our profession. How can my continued schoolboy love for and fascination with surveying be passed on to a younger generation?

*(Mo Surveyor) What do you think is the most important quality a board should have?*

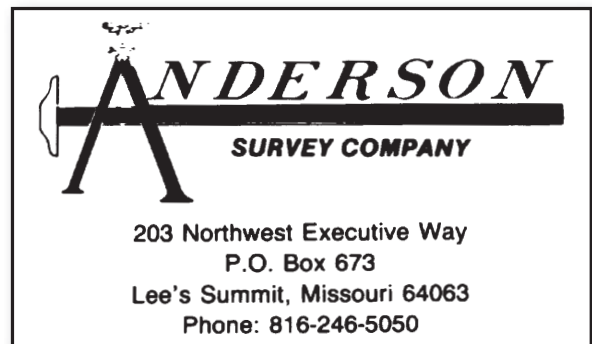
**(RR)** Most of the surveyors I know, (myself included) are blessed with a healthy dose of “Rugged Individualism”. Bringing this attribute into any group of two or more, requires the qualities of patience, a willingness to compromise and the intestinal fortitude to “stand in the gap” when a united front is needed.

*(Mo Surveyor) What is the most important quality for a board member to have?*

**(RR)** The quality of being not only a “hearer” but a “listener”. Sometimes I hear my wife... but I don’t listen... Our MSPS Board and membership are full of people with great ideas, strategies and insights for us to consider. To quote *Louis L’amour* in “*The Daybreakers*”; “A man can learn a lot if he listens, and if I didn’t learn anything else, I was learning how much I didn’t know.”

*(Mo Surveyor) What do you consider your most important contribution to MSPS?*

**(RR)** Availability. Every surveyor has (or should have) a certain level of experience and expertise, with two or three opinions thrown in for good measure. But for various reasons, not everyone can be available. For my tenure on the MSPS Board of Directors, I want make myself available and apply myself, to the highest degree possible, to the business at hand.



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Govero Land Services, Inc.	Daniel Govero	5929 Old State Rd.	Imperial, MO 63052
Burdine & Associates, Inc.	Daniel Zervas	1638 Jeffco Blvd.	Arnold, MO 63010
Zahner & Associates, Inc.	Michael Zahner	200 Zahner Place	Perryville, MO 63775
Allstate Consultants, LLC		3312 Lemone Industrial Blvd.	Columbia, MO 65201
Anderson Survey Company	James Anderson	203 NW Executive Way	Lee's Summit, MO 64063
Koehler Engineering & Land Surveying, Inc.	Chris Koehler	194 Coker Lane	Cape Girardeau, MO 63701
Amsinger Surveying, Inc.	Dennis Amsinger	101 S. Crittenden, Rm. B-3	Marshfield, MO 65706
Musler Engineering Co.	Richard Musler	32 Portwest Court	St. Charles, MO 63303
Central MO Professional Services, Inc	Keith Brickley	2500 E. McCarty	Jefferson City, MO 65101
Robert S. Shotts, Inc.	Robert Shotts	267 East Third Street	Lebanon, MO 65536
Grimes Consulting, Inc.		12300 Old Tesson Rd., Ste. 300 D	St. Louis, MO 63128
Marler Surveying Co., Inc.	Marty Marler	11402 Gravois Rd., Ste. 200	St. Louis, MO 63126
Doering Engineering, Inc.	Mark Doering	5030 Griffin Road	St. Louis, MO 63128
Shaffer & Hines, Inc.		PO Box 493	Nixa, MO 65714
Affinis Corp.	Robert Ubben	8900 Indian Creek Parkway, Ste. 450	Overland Park, KS 66210
Bowen Engineering & Surveying, Inc.	Chris Bowen	2121 Megan Drive	Cape Girardeau, MO 63701
St. Charles Engineering & Surveying, Inc.	Michael Meiners	801 S. Fifth St., Ste. 202	St. Charles, MO 63301
Midland Surveying, Inc.	Troy Hayes	501 N. Market	Maryville, MO 64468
Taliaferro & Browne, Inc.	Hagos Andebrhan	1020 E. 8th St.	Kansas City, MO 64106
Cochran	Steven Laune	530 A E. Independence Dr.	Union, MO 63084
Aylett Surveying & Engineering		201 NW 72nd Street	Gladstone, MO 64118
Pickett, Ray & Silver, Inc	David Skornia	22 Richmond Center Court	St. Peters, MO 63376
Whitehead Consultants Inc.	Michael Taylor	114 N. Main St.	Clinton, MO 64735
Pellin Surveying LLC		6408 Hwy AJ	Washington, MO 63090
Schlagel & Associates, PA	David Rinne	14920 W. 107th St.	Lenexa, KS 66215
Ruble Surveying, Co.	Craig Ruble	PO Box 367, 801 S. McArthur	Salem, MO 65560
Frontenac Engineering Group, Inc.	William Berthold	2725 Sutton Blvd. B	St. Louis, MO 63143
Cardinal Surveying & Mapping, Inc.	Shelly Clark	PO Box 278	Cottleville, MO 63338
Surdex Corporation	Steve Kasten	520 Spirit of St. Louis Blvd.	Chesterfield, MO 63005
Bader Land Surveying, Inc.	Gerald Bader	16255 Sugar Bottom Road	Ste. Genevieve, MO 63670-8613
West Wildwood Surveying, LLC	Edward Weman	8023 Waddell Avenue	St. Louis, MO 63125
Integrity Engineering, Inc.	Terris Cates	PO Box 700, 1714 E 10th Street	Rolla, MO 65402
Pitzman's Co. of Surveyors & Engineers	William Berthold	2725 Sutton Blvd.	St. Louis, MO 63143
Poepping, Stone, Bach & Associates, Inc.	Patrick Poepping	801 Broadway, Ste. 248, PO Box 190	Hannibal, MO 63401
Minnick Surveying, LLC		7905 Big Bend Blvd., Ste. 101	Webster Groves, MO 63119
Olsson Associates	Patrick Ward	7301 W. 133rd St., Ste. 200	Overland Park, KS 66213
The Sterling Company	George Gower	5055 New Baumgartner Road	St. Louis, MO 63129
Volkert, Inc.	Jason Schreckenber	1101 Eastport Plaza Drive, Ste. 100	Collinsville, IL 62232
Engineering Solutions		50 SE 30th Street	Lee's Summit, MO 64082
Thouvenot, Wade & Moerchen, Inc.	Derek Twente	4940 Old Collinsville Road	Swansea, IL 62226
Cochran	James Park	8 E. Main Street	Wentzville, MO 63385
Powell and Associates, LLC		901 NW Vesper Street	Blue Springs, MO 64015
Brungardt Honomichl & Co., P.A.		7101 College Blvd., Ste. 400	Overland Park, KS 66210
Cook Flatt & Strobel Engineering	Michael Adams	2930 SW Woodside Drive	Topeka, KS 66614



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