Missouri Surveyor

A Quarterly Publication of the
Missouri Society of Professional Surveyors

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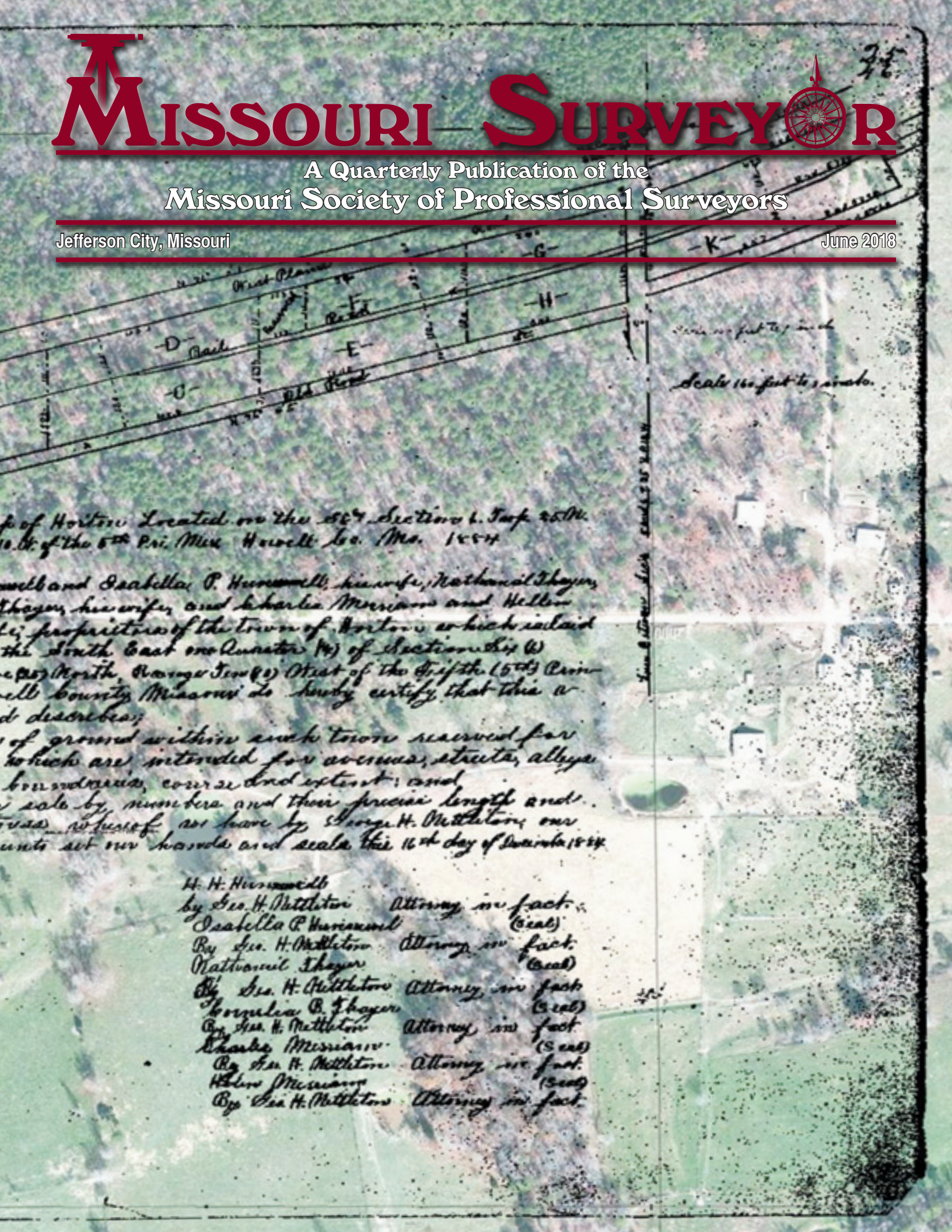

CALENDAR OF EVENTS

2018

July 14, 2018
Board Meeting
MSPS Office, Jefferson City, MO

August 22-24, 2018
Review Course, Best Western
Capital Inn, Jefferson City, MO

October 3-6, 2018
61st Annual Meeting and Convention
Tan-Tar-A Resort,
Osage Beach, MO

December 1, 2018
Board Meeting
MSPS Office, Jefferson City, MO

2019

May 2-4, 2019
41st Annual Spring Workshop
Lodge of Four Seasons,
Lake Ozark, MO

September 10-12, 2019
62nd Annual Meeting and Convention
Holiday Inn Executive Center,
Columbia, MO

Cover photo is part of an historical research project by Ralph Riggs of old railroad towns in Howell County. This particular map is the town of Horton located at the end of a now abandoned spur line in the Mark Twain National Forest. The original plat has been overlayed onto current aerial photography. He is currently working with a local museum to prepare a display related to historical towns and stations along the railroads in Howell County.

Donald R. Martin, Editor

Notes from the Editor's Desk

Donald R. Martin

My fellow readers, welcome to the June 2018 Edition of *Missouri Surveyor*! Back again with another newsletter featuring surveying related news to hopefully spark your interest and calm your curiosity. Oh, and ol' pard Tripod the three legged ground hog has been prodding me along with the point of his red pencil and the points of his barbed comments. Take it easy Tripod and let us present the summer stories of surveyors and surveying to our Society and seekers of sagas and statements from specially skilled scriveners of our specialty in spatial struggles.

First up is *Options for a State Plane Coordinate System of 2022* by Missouri State Surveyor Ronnie Heimbaugh with news of localized options in our near future. Ronnie's information is followed by Joe Clayton's recollection of a cave discovery and survey in *Stadin Elbow*. After Joe's tale of spelunking surveyors comes a remembrance of our fellow Missouri surveyor *Jerry Day*. May God bless the family, friends and Society members missing Mr. Day – his legacy endures. Following this solemn news is an opportunity to give-back in *NCEES Seeks Volunteers for Surveying Exam Review*. Then there is a short piece from outsider media with *Common Sources of Land Surveying Problems* by attorney Sam Moak. This featured commentary for the Huntsville (Texas) Item is as fine an explanation of that which surveyors deal with as you will ever read from a non-surveyor. Glad I found that one! Editor Perry Turnick from Point of Beginning shares his comments next in *Editor's Points: Professional Survey Groups Adapt to Change*. Then we have our friends at Inside GNSS sharing Mark Petovello's *How Does Earth's Rotation Affect GNSS Orbit Computations?* Then break from the spinning orb's effects on space vehicle positions with the *2018 Spring Workshop* photo montage and *Exhibitor Thank You* by Abi Padgett and Sandy Boeckman. MSPS is ever grateful for the fine vendors who serve and support surveyors throughout Missouri.

Making our way through the Newsletter we come to another shared piece – this one from Commercial UAV News. *Drones (Photogrammetry) vs Terrestrial LiDAR – What Kind of Accuracy Do You Need?* by Jonathan Barnes tries to answer the inquiry in its title. Next we have the first of two articles from University of Maine professor Knud E. Hermansen, *What's New with Surveying Education*. This is followed by *News from the National Geodetic Survey* and then NSPS's *News & Views*. After those two we have Knud's return for article number two, *Reminisce of An Old Surveyor, Part III – Other Equipment*. Then there is a brief report of surveyor impacting news from Missouri's statehouse in *Capitol View*. Wrapping things up is *Odds & Ends*, a mix of news in brief form.

I hope you enjoy this edition and remember *Missouri Surveyor* is your voice; I welcome that which you may have to say, write and show.

Donald

Important!

MSPS members, go to page 44 and take care of business!
We are looking for **Awards Nominees** for the **Surveyor of the Year** and the **Robert Myers Service Award**. ***Go, now!***

THE MISSOURI SURVEYOR

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President's Message

Gerald Bader, PLS

Good Day and What? No Spring? I hope this letter finds everyone healthier, wealthier and wiser.

The *Spring Workshop* was held on May 4 and 5 at the Lodge of the Four Seasons (Deeds… Descriptions and beyond). The program was well attended and received. With speakers like Kristopher Kline and Darrell Pratte, how could you be disappointed. Thanks to the Education Committee Chair Dan Govero for a great workshop. Beside the seminars and exhibits we had a first-time event; on Friday night *Young Surveyors Committee* Chair Casey Young hosted a "meet and greet" at the Lodge's fire pit. There were 14 attended all under the age of ??. Yes, I did say Young Surveyors. Thanks to those wanting to get involved.

On April 19, I had the pleasure of attending an open house for the *Survey Program* at the *Southern Illinois University at Edwardsville*. This meeting coincided with the *Southwest Chapter of the Illinois Professional Land Surveyors Association* meeting. There are currently 45 students in the program and they had a very interesting presentation on the program. Mr. Dave Sherrill is the land survey program coordinator and thanked MSPS for our support. He offered to attend a meeting and provide more information on the progress of the program.

MSPS had a booth at the *Unmanned Airborne System (Drones) seminar* at Linn Technical College in Linn, MO. Hope you were able to attend.

The *Southwest Chapter* will be hosting a workday on June 21st to add Opus Observations to the 2022 Datum. If you are interested contact Monnie Sears, LS @ monnie.sears@amce.com. Thanks to the Southwest Chapter.

The *Legislative Report*: With the guidance of Robert Ross, language was added to HB1718 which repealed any requirement for letters of reference in order to apply for enrollment as a LSIT or PLS. Thanks to Robert, Bart Korman and Rocky Miller for their support of MSPS. On a downer MSPS spent more time on the defense then offense. One of the biggest concerns: the Legislature needing more revenue and were looking at the Board of Registration's reserve. Again, this is our dues and not a tax. Thanks to everyone who took the time to contact their senator and representative. Thanks to Rich Barr and Jim Anderson, Co-chairs, for the legislative committee and the committee. They do a great job, year after year. For more information go to www.govwatch.net.

The next *MSPS meeting* will be on July 14th at the MSPS Office, Jefferson City. If you would like join in on the fun, let us know. The Review Course is August 22-24 at the Best Western Capital Inn, Jefferson City.

Do not forget the *Annual Meeting* at Tan-Tar-A on October 4-6, 2018, mark your calendar. I'm sure Dan has a great line up. Thanks again to Dan Govero, Education Committee chair, for his and the committee's dedication and for providing outstanding programs. Contact Dan if you have a topic you would like to see presented or would like to be on the education committee.

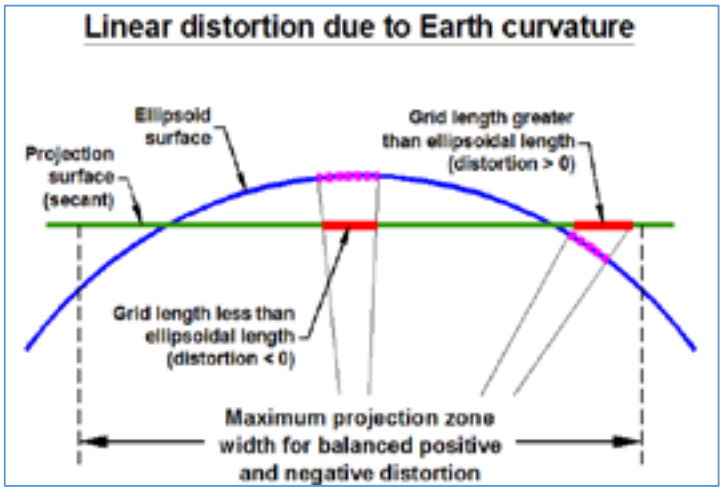
In closing, do not forget to pause for the marble.

"Duck"

Options for a State Plane Coordinate System of 2022

by Ronnie Heimbaugh, Missouri 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). So a new horizontal datum and a new vertical datum are coming in 2022. Along with a new horizontal datum, states will have new state plane coordinate systems, State Plane Coordinate System of 2022 (SPCS2022). This article will focus on options concerning SPCS2022.

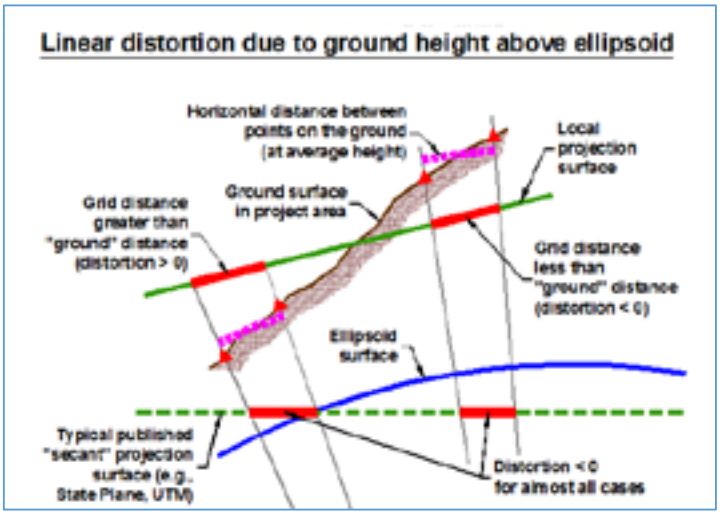


National Oceanic and Atmospheric Administration's (NOAA) National Geodetic Survey (NGS) recently posted on the Federal Register the "Notice of proposed change to the State Plane Coordinate System; request for comments." NGS has developed a draft policy and procedures that propose defining characteristics and requirements for the State Plane Coordinate System of 2022 (SPCS2022). These documents also provide mechanisms for user input on initial design of SPCS2022 and subsequent changes. NGS is inviting written comments from stakeholders on the draft SPCS2022 policy and the use of "special purpose" zones. These zones could include urban areas such as St. Louis and Kansas City. These urban areas span across different state plane coordinate zones and could benefit from a special zone that covers the entire urban area. NGS will accept comments from stakeholders until Friday, August 31, 2018. The stakeholders in Missouri include: state GIS or cartographer's office, Land Survey Program (LSP), Missouri Department of Transportation (MoDOT), state professional surveying and engineering societies, and universities that perform geospatial education or research.

One option available with SPCS2022, not available with previous state plane coordinate systems, is the option to use low distortion projection zones, or LDP zones. *"The term 'low distortion' refers to minimizing the linear horizontal distortion from two effects: 1) represent a curved surface on a plane and 2) departure of the elevated topography from the projection surface due to variation in topographic height of the covered area"* (Armstrong).

According to Michael Dennis, NGS Geodesist and owner of Geodetic Analysis, *"Projected coordinate systems are distorted – it is a Fact of Life. Linear distortion is the difference in distance between a pair of projected (map grid) coordinates and the true horizontal 'ground' distance on the surface of the Earth."* Dennis adds, *"Although this distortion cannot be eliminated, it can be minimized using Low Distortion Projections (LDPs)."* The current Universal Transverse Mercator (UTM) and the State Plane coordinate projections have substantial distortion. Several states have implemented LDP zones. Some are single county projections; others are multi-county projections. While researching LDP zones and their possible benefits for Missouri surveyors, the LSP discovered that MoDOT had been looking into LDP zones for their projects. In 2017 discussions began between the Land Survey Program and MoDOT Land Surveyors regarding the design of an LDP system on a county by county basis for MoDOT's projects. The goal was to create smaller zones, minimizing the distortion to a level in which the grid coordinates and ground coordinates would be considered the same in most surveying applications. After completing the rigorous design, the project would be thoroughly tested by MoDOT and the LSP.

The LDP would also eliminate localizing or site calibration thus improving surveying efficiency for MoDOT and their contractors. The original plan for the LDP zones was to add it as another option to the existing three-zone system.



In April of this year, NGS released a notice identifying LDP zones as a viable coordinate system to replace the current three-zone system. However, linear distortion has to be between 20 and 50 ppm. The original goal of LSP and MoDOT was to keep the linear distortion minimal, preferably under 20 ppm for most of the area of a zone. This would ensure LDP coordinates are within the accuracy requirements of Missouri Survey Standards. Current NGS draft policy requires the following if the state requests LDP zones:

- NGS will allow only two layers of Coordinate Systems in the current Draft Policy, excluding special purpose zones.
- Low-distortion zones will replace the current three-zones (a state can have one or the other, not both).
- NGS will create a single statewide zone as a second layer for GIS users.
- States create their own LDP zones subject to NGS approval.
- LDP zones will be designed for a linear distortion range between 20-50 ppm utilizing a minimal number of zones. Approximately 20 zones are sufficient to obtain 20-50 ppm linear distortion for Missouri according to NGS.
- All stakeholders will have to agree to use the LDP zones as the basis for SPCS2022 if registered with NGS.

Should Missouri decide not to register the LDP, NGS will use default definitions, which are the same three-zones Missouri now enjoys with the following modifications:

- The linear distortion will be evaluated at the topographic surface, not the ellipsoid surface, as is the current case.
- The three-zones will be evaluated according to topography and population and optimized to create the lowest distortion for each zone, as a result, likely changing the scale factor and the position of the central meridian for each zone.
- The position where geodetic north equals grid north may change within each zone.
- NGS may add "special purpose" zones for Kansas City and St. Louis.
- NGS may create a single statewide zone as a second layer for GIS users.

With this scenario, Missouri surveyors would not be able to get low-distortion coordinates directly from OPUS. However, after some investigation into the practices of states currently using LDP zones, there is a procedure to get these projections and their parameters as an option in data collector software once the LDP zones are finalized. So, does the good outweigh the bad?

For MoDOT surveyors, engineers and designers, the answer is easy, yes. Placing the parameters of the county in the data collector is the most difficult part of the project, which will be added as an option in the collector. In theory, the coordinate collected in the initial design and engineering phase will be used in the project stakeout and machine control during construction without change. This makes sense for countywide GIS applications, especially on the cadastral layer. It seems intuitive that once surveyors, GIS users, designers, and engineers become familiar with the LDP system, they will adopt it.

Will dividing Missouri into 20 zones with linear distortion of 20 to 50 ppm suffice for MoDOT? Will it suffice for property boundary surveys? Before considering using the 20-zone option as the configuration for Missouri, these questions need answered. Based on the Land Survey Program's preliminary results of 14 countywide LDP zones, it is common to have linear distortion of 15 to 20 ppm or less on 90-95% of each zone. Using countywide zones definitely reduces the linear distortion. The NGS requirement of larger multi-county zones creates larger distortions.

Other questions for consideration: Are special purpose zones in Kansas City and St. Louis beneficial? Do statewide GIS users want a single statewide zone as a second layer?

The Missouri Land Survey Program plans to comment on the NGS draft policy concerning State Plane Coordinates

(continued on page 7)

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2022. As a State, all these stakeholders should band together asking for adjustment and modification of the NGS policy to meet the needs of surveyors, engineers, GIS users and other state plane coordinate users within Missouri. Missouri can also team up with like-minded states to improve the national policy. Submit any comments and preferences to landsurv@mda.mo.gov or call (573) 368-2300.

This is not a comprehensive summary of the SPCS2022 Policy and Procedures. This document provides a brief overview to highlight the items that need further discussion before formulating and submitting comments to NGS as Missouri stakeholders. Below are the deadlines that are in the NGS Draft Policy that would have to be met depending on which route/routes we take.

- Deadline for comments to NGS's Draft Policy no later than August 31, 2018
- Requests for zones designed by NGS or proposals for zones designed by contributing partners must be received by NGS no later than December 31, 2019
- For NGS-approved proposed designs by contributing partners, final defining parameters must be received by NGS no later than December 31, 2020
- Confirmation of final design characteristics and computations will be provided by NGS to stakeholders and contributing partners no later than December 31, 2021

For additional information on SPCS2022, see the following websites:

Federal Register Notice
https://www.federalregister.gov/documents/2018/04/18/2018-08141/policy-and-procedures-documents-for-the-state-plane-coordinate-system-of-2022

Draft Policy
https://www.ngs.noaa.gov/INFO/Policy/files/DRAFT_SPCS2022_Policy.pdf

Draft Procedures
https://www.ngs.noaa.gov/INFO/Policy/files/DRAFT_SPCS2022_Procedures.pdf

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Armstrong, Mark L., Ken Bays, Dennis Michael, and Joseph Thomas. Oregon Coordinate Reference System. Version 3.01. Oregon Department of Transportation Highway Division Geometronics Unit, 2017. Web. Accessed 10 May 2018. ftp://ftp.odot.state.or.us/ORGN/Documents/ocrs_handbook_user_guide.pdf

Dennis, Michael. "Ground Truth: Design and Documentation of Low Distortion Projections for Surveying and GIS." Handout. Professional Land Surveyors of Oregon Annual Conference. 2015. Web. Accessed 10 May 2018. https://www.plso.org/resources/documents/dennis%20ground_truth_handout_v22_plso_2015.pdf

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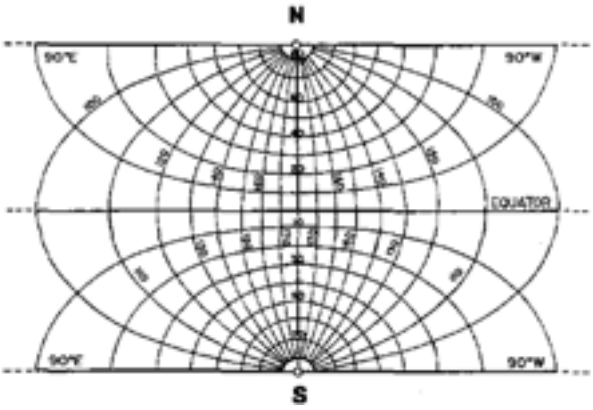


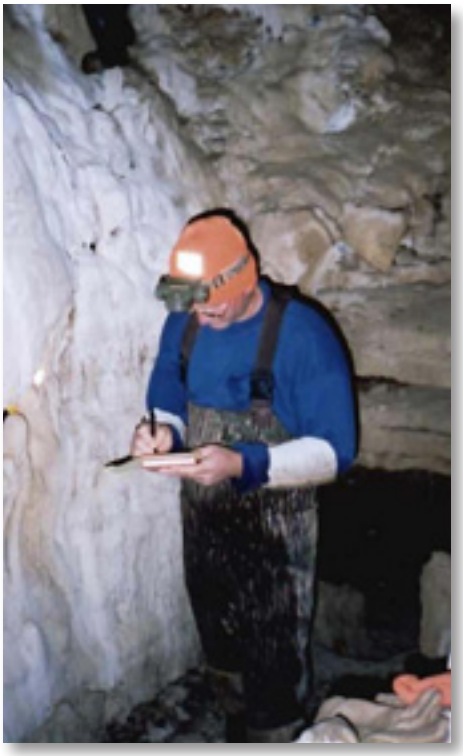
Stadin Elbow

by Joe Clayton

Most of you already know Missouri was known as the Cave State before "Show Me" became our state's calling card. Early in 2002 while working for MoDOT one of our survey crews was informed by a land owner of a cave opening that emerged at the head of a low flowing spring on property. This cave was located on what was the proposed center line of the soon to be completed Interstate 49 very near the Arkansas border in McDonald County. One thing was clear to the MoDOT team we needed to avoid the cave and as such we would need to locate and map the cave. We needed to call on an expert.

Justin Forrest inside Stadin Elbow.

If you attended Missouri State University, f.k.a. SMSU, during the end of the last century until his untimely death in 2004 you enjoyed Dr. Kenneth Thomson, Geologist and experienced cave explorer/mapper, discussions of surveying caves, stressing the importance of proper survey procedures, while crawling in confined spaces. Dr. Thomson was the first person we contacted. He happily supplied a grocery list of supplies for successful cave exploration; waders, elbow pads, knee pads, headlamps, waterproof field books, etc…Dr. Thomson wished us well and lamented if our call would have came a few years earlier he would have crawled around in the cave with our crew.



Brad McLoud keeping field notes in a cave.

So starting early in November 2002 and finishing in early January 2003, at intermittent times when above ground work was prohibited by some of the worse winter weather in decades; we dispatched a crew of 3 into the darkness. Justin Forrest, Brad McCloud and Steve Dickson performed the field survey creating hand scribed notes that were then used to create coordinate files for mapping onto our design surface. GPS control, base line and levels all done on the squeeze in wet muddy guano laden darkness, devoid of surface comforts with only spiders and albino crickets for company; they trudged their task to competition.

The main topics discussed by Justin at the time was his 6' 4" frame was not built for the 50 feet he had to crawl for "water breaks" and "there's BATS", but for MSPS member Steve Dickson, MSPS Board of Directors member Brad McCloud it was a once in a lifetime chance and foreshadowing of their careers yet to come! Justin's light hearted complaining aside I never saw a frown in any photographs. Justin later noted, while watching the sky light up all night with RPG fire over Bagdad International, he missed the safe little cave, being able to see the stars as it turns out is over rated.

(continued on page 10)

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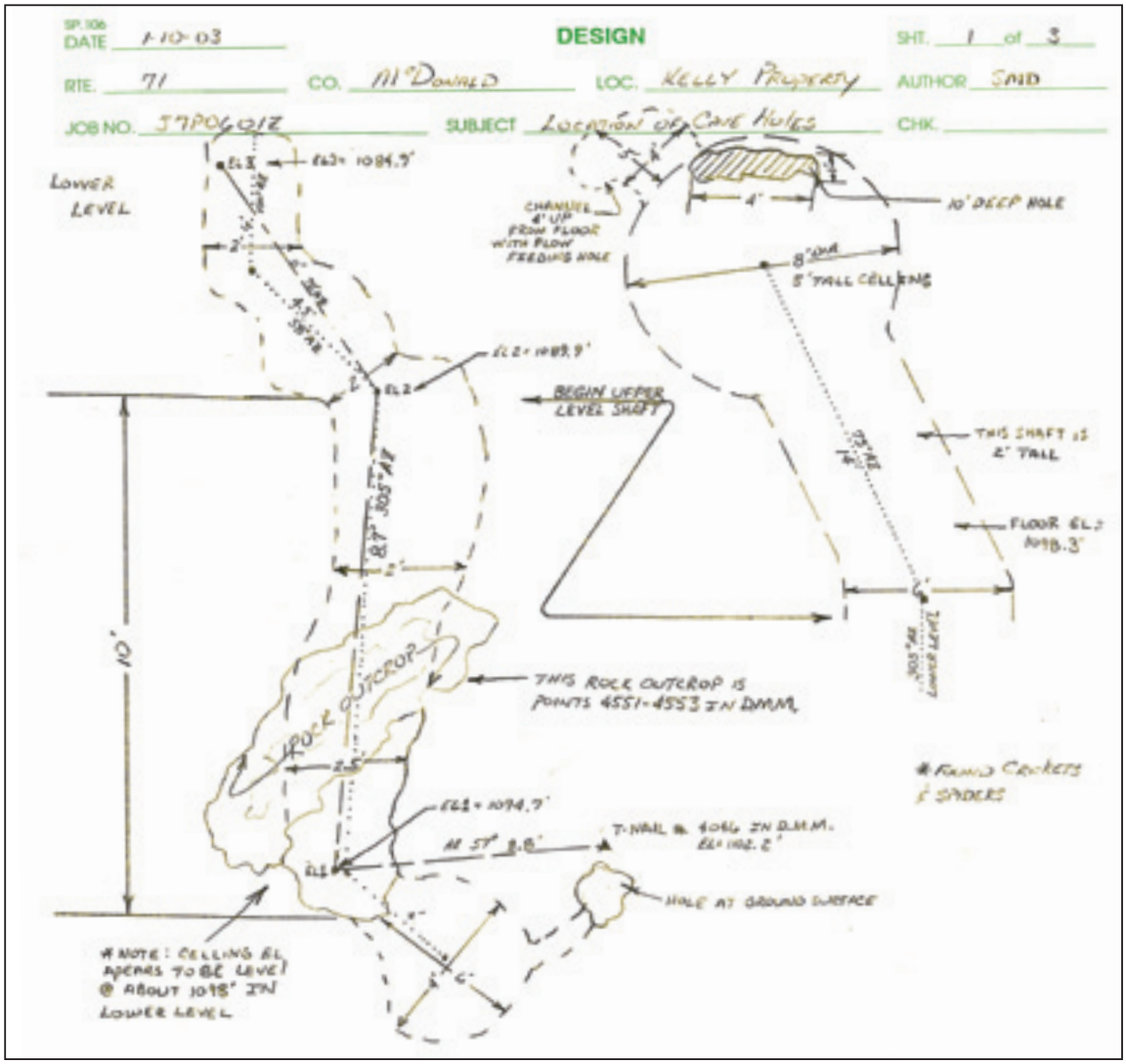
Stadin Elbow *(continued)*

When the time came to submit the cave exploration paperwork to Federal Highway Administration it only seemed fitting Brad, Justin and Steve name the cave, having been the folks who explored it.
Three years later, only adding to their credentials as cave explorers, the June 2006 issue of the Southwestern Naturalist detailed the discovery of the flatworm, *Dendrocoelopsis american* as the first such sighting in Missouri at Stadin Elbow Cave.

The foreshadowing; Brad and Steve are now employed by the Missouri Department of Conservation.
The naming of the cave; the elbow part is alliterate, but why Stadin, why such a name?
STeve, brAD nor justIN would say.

Steve Dickson in the friendly confines of Stadin Elbow.

Below; Steve Dickson's sketch of Stadin Elbow.



Jerry Lee Day, PLS; 1934 - 2018

Springfield, MO. – Missouri Surveyor Jerry Day passed away on Tuesday, April 10th. Born to Warren and Myrtle Day in Conway, Missouri on January 30, 1934, the family moved to Baxter Springs, Kansas to a working farm before moving to Springfield, Missouri permanently. Jerry attended Senior High School (Central) and graduated in 1952. He entered the U.S. Army and served in Korea before returning to Springfield.

After his military service Mr. Day began a career in surveying and engineering. First with the Greene County Surveyors office and later with Butler & Associates, an architectural and engineering firm, where his position took him to many places in the U.S. and culminated with him as a vice president for the firm in Tampa, Florida. Jerry returned to Springfield to establish his own firm, Day & Associates in 1973. Back in his hometown, Jerry returned to Drury University and graduated with a degree in business.

Mr. Day was appointed to the Board of Architects, Engineers and Land Surveyors for the state of Missouri. He was instrumental in the establishment of the Missouri State Professional Land Surveyors Ozark Chapter. In 2009 Jerry was awarded the first ever *Excellence in Surveying* award and was also given the distinction of having the award named after him. Jerry was passionate about his business which he conducted with the utmost of integrity and ethical behavior. He considered his greatest contribution to be the family, friends and associates that he mentored in his 30+ years in business.

Jerry met and married the love of his life, Ronda Cantrell on February 17, 1962. They retired together in 2010 Jerry was preceded in death by his parents, his brother Donald and his son Mark. He is survived by his wife of 56 years, Ronda, his son Greg and his family (Valerie, Branden and Bailey), his brother Gary and his wife Norma, and many nieces and nephews.

MSPS In Process of Completing New Online Minimum Standards Courses

State Land Surveyor Ron Heimbaugh will offer two one-hour online courses on the **new** Minimum Standards. Monitor the MSPS Online Education Portal; they will be available sometime in April. Go to the MSPS website, or more directly…

https://msps-geolearn.wcea.education/

Also coming shortly after the above course is available, more courses from Missouri Land Survey staff on other standards which can be used towards the Board's requirement for courses in 20 CSR 2030-8.020 Professional Land Surveyor—Professional Development Units … (A) Of the required professional development units, licensed professional land surveyors shall complete a minimum of two (2) professional development units in **Surveying Standards** (20 CSR 2030, Chapters 16 and 17, and/or Chapters 60 and 327, RSMo) during the two- (2-) year period immediately preceding renewal. …

These will include: *Corner Registration and Mapping Survey Standards* by Scott Faenger & Tyler James in one one-hour course, and
Standards for Digital Cadastral Mapping, Horizontal and Vertical Control & Surveyor's Real Property Report by Jamie Elliott, Jess Moss and Ron Lather in one one-hour course.

NCEES Seeks Volunteers for Surveying Exam Review

May 3, 2018

NCEES is currently seeking surveying professionals to participate in a content review for the Fundamentals of Surveying (FS) exam.

The results of this survey will be used to update the specifications for the exam, which is typically the first step in the process leading to professional surveying licensure. NCEES requires a cross section of professionals—including licensed professional surveyors and academics teaching surveying courses—from all surveying disciplines to complete an online survey about the fundamental knowledge and skills necessary for a recent surveying graduate to work in a manner that safeguards the health, safety and welfare of the public. The survey can be completed in 20–30 minutes.

"These studies help NCEES ensure its licensing exams remain relevant to current professional practice," says Tim Miller, P.E., director of exam services. "The value of this content review depends on the number of people who participate, so NCEES is eager to get input from as many surveying professionals as possible."

The survey is open at ncees.org/FScontentreview until August 20.
For more information, email FScontentreview@ncees.org.

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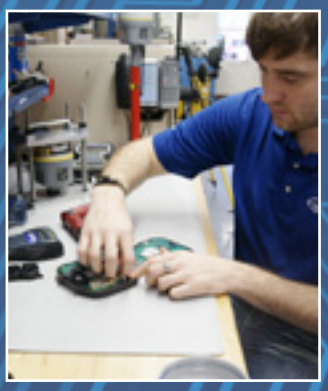

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Common Sources of Land Surveying Problems

by Sam A. Moak, The Legal Corner, Apr. 29, 2018, The Huntsville (Texas) Item

The information in this column is not intended as legal advice but to provide a general understanding of the law. Any readers with a legal problem, including those whose questions are addressed here, should consult an attorney for advice on their particular circumstances.

The most common source of boundary problems in rural lands is simply the passage of time. Large tracts of land often stay in the same families for decades. During that time, there is usually no reason to have the property surveyed. Also during those long stretches, friendly relations develop between neighbors, accommodations are made and things are fine between neighbors for many years.

Unfortunately, good neighbors eventually die and their heirs, who do not live in the area, wind up owning the land or selling it to someone else who is not from the area. At that point, long-standing but undocumented understandings are lost or suddenly no longer recognized. Neither the seller nor the buyer is familiar with the land or its history, and the survey makers placed or referenced over 50 years earlier are no longer where they were. Old stakes and witness trees are long gone. River banks and stream beds have drifted to new locations. There may be precious little physical evidence of the correct property boundaries.

Sometimes the discrepancies are within the original legal description itself. Sometimes there are conflicting descriptions between adjoining properties. Water boundaries, shore lines, river banks and stream beds present their own set of challenges.

In these situations, it becomes more evident than usual that boundary reconstruction is a matter of professional judgment by the surveyor. One of the most common misperceptions about land surveying is that it is a purely mechanical process of measurements and mathematical calculations. While that is the scientific part of surveying, a substantial amount of subjective, usually historical, analysis is also required.

Almost all surveyors will describe their profession as part science and part art. The artfulness comes into play as an expert evaluation of historical evidence, resulting in the formation of professional opinions regarding the subject of the survey.

Land surveyors take special continuing education courses that provide experience using and understanding the land surveying equipment and practices of the 19th and 20th centuries. These courses help the surveyor to better evaluate metes and bounds descriptions from those eras and to aid in the search for the types of physical evidence those old surveyors may have left behind.

I hope the information provided here provides some clarity as to the purpose of a survey and when one is necessary. However, if you have a question regarding a survey, you should contact the surveyor who prepared the survey, a local surveyor or an attorney familiar with real estate.

Sam A. Moak is an attorney with the Huntsville law firm of Moak & Moak, P.C. He is licensed to practice in all fields of law by the Supreme Court of Texas, is a member of the State Bar College, and is a member of the Real Estate, Probate and Trust Law Section of the State Bar of Texas.

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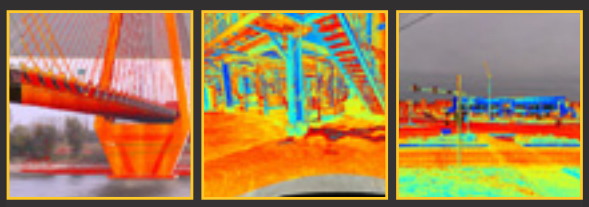

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Missouri Society of Professional Surveyors

Surveyor's Review Course

August 22-24, 2018

Best Western Capital Inn, Jefferson City

PROGRAM

Wednesday, August 22 ~ 1:00 - 6:00 pm

Surveying Math *(Bring your NCEES-approved calculator)*

- ❑ Calculator Use & Basic algebra
- ❑ Trigonometry and Geometry
- ❑ Traverse Calculations and Coordinate Geometry
- ❑ Surveying Math Applications

Thursday, August 23 ~ 8:00 am - 5:30 pm

Surveying Fundamentals

- ❑ Errors Analysis & State Plane Coordinates
- ❑ Route Surveys, GPS & GIS
- ❑ Exam Preparation, Legal Principles & Definitions

Friday, August 24 ~ 8:00 am - 3:30 pm

Missouri Practice

- ❑ Missouri Standards & Board Rules
- ❑ Missouri GLO System, Resurveys on Missouri's GLO system (RSMO Chapter 60)
- ❑ Other Missouri Statutes, Riparian Boundaries

This course is appropriate for those who will be taking any part of the surveying licensing exams, or for those already licensed and wish to review surveying topics and receive PDUs.

INSTRUCTORS

Dr. Joseph Paiva, PLS, is a geomatics and business development expert and a former university educator, who is now CEO and Principal of GeoLearn (www.geo-learn.com), an online education company specializing in courses for professionals and technicians in the geospatial industry.

Dr. Dick Elgin, PLS, PE, works for Archer-Elgin Surveying and Engineering, LLC (Rolla). He authored "The U.S. Public Land Survey System for Missouri."

Mike Flowers, PLS, is the former Missouri State Land Surveyor. He is a member of the Missouri Board of Architects, Professional Engineers, Professional Surveyors and Landscape Architects.

All are well known surveying professionals. Joe Paiva helped found the Review Course and for years all three have previously taught parts of it.

This course has been approved for continuing education credits from the Missouri Board for Architects, Professional Engineers, Professional Land Surveyors and Landscape Architects for the following hours:

Wednesday — 5.0 PDUs
Thursday — 8.5 PDUs
Friday — 6.5 PDUs

COURSE FEE SCHEDULE (Please check appropriate boxes)	MSPS Member	Non-MSPS Member
❑ Wednesday and either Thursday or Friday	$600	$600
❑ Thursday and Friday	$750	$800
❑ All Three Days	$900	$1,000
❑ Wednesday Only	$250	$250
❑ Thursday Only	$500	$500
❑ Friday Only	$450	$450

Missouri Society of Professional Surveyors

Surveyor's Review Course

August 22-24, 2018
Best Western Capital Inn
1937 Christy Drive
Jefferson City, MO 65101

LOCATION AND LODGING

A block of rooms has been reserved at the Best Western Capital Inn in Jefferson City, Missouri, at a rate of $101.69 plus applicable taxes excluding blackout dates for single king or double queen occupancy which includes a Full Hot Breakfast each morning. **Deadline for reservation is July 25, 2018.** Make your reservation by calling 573-635-4175 and refer to "MSPS rate" when reserving your room.

CANCELLATION POLICY

MSPS reserve the right to cancel the program and return all fees in the event of insufficient registration. A participant may cancel a registration up to two weeks before the course date and receive a full refund. **NO REFUNDS will be given after August 15, 2018.**

Review Course Registration

Name _____ PLS # _____

Firm _____

Address _____

City, State _____ Zip _____

Phone _____ Email _____

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❒ Visa/MasterCard/Discover/American Express ❒ Check Enclosed ❒ Invoice my Firm

Card # _____ Exp. Date _____ CVV Code _____

Total Amount: $_____

To Register, detach and mail payment to: MSPS, PO Box 1342, Jefferson City, MO 65102
Phone: 573-635-9446 ~ Fax: 573-635-7823 ~ Email: msps@missourisurveyor.org
Registration Deadline: August 15, 2018

Editor's Points: Professional Survey Groups Adapt to Change

by Perry Trunick, March 1, 2018, Point of Beginning

Making blanket statements is a dangerous thing. A case in point: There's an old line that says it is the nature of every organization to outlive its purpose. If that were true, we all may as well pack it in because there is no future. What needs to be included in that statement is a single word: "original."

The goal of an organization should be to outlive its original purpose. But in doing so, it should evolve and embrace a new purpose and redouble its efforts to outlive that purpose in turn. The key is in what you do once you have achieved the original goal.

In the first two months of 2018, we're witnessing some realignment among professional associations serving surveyors and geospatial professionals. Perhaps the most dramatic is the change at MAPPS, which has decided to restructure to give its members more value. The role of the association has grown over its 35 years, and so have the needs of its members and the professions it serves.

One part of the re-formed MAPPS will be association management – events, education, and other member-related activities. Another will be the legislative efforts. The third, which the board will initially manage, is the legal and accounting area – the nuts and bolts of the business. At the risk of making it all sound too compartmentalized, from the outside, it looks like the legislative group won't have to do double duty lobbying and planning semiannual conferences.

At its winter meeting in late January, the MAPPS board focused on fine tuning the organization's strategy and developing its value proposition. If the new structure allows a more efficient application of resources to fulfilling its strategic goals, the value proposition should be apparent.

The second event of note was the co-location of ASPRS and ILMF. There are enough similarities and differences in the two events that the combination was attractive enough to draw 50 percent more attendees to the Denver venue. Organizers didn't specify beyond saying the increase was across the joint sessions, but it was clear the single pass that allowed ASPRS attendees to sit in ILMF sessions and vice versa was proving beneficial. In the exhibit area, attendees clearly took advantage of the opportunity, and exhibitors seemed happy with the addition of more surveyors to the mix courtesy of the ASPRS affiliation.

One thing the ASPRS/ILMF events demonstrated was the importance technology plays in the everyday business of surveying.

We heard more talk about collaboration and integration at InterGeo in Berlin last September, and we're seeing that evolving on many fronts. The focus is turning to solutions that best serve the geospatial market. For manufacturers and technology companies that may mean becoming a bit less proprietary. For the associations, it is recognizing how best to allocate resources to achieve individual goals with a collective benefit.

We can't make any blanket statements, but if they take the lessons and collective knowledge gained in reaching this point and focus on new goals and objectives that help take surveying and geospatial professions into the future, they will remain relevant and not outlive their purpose.

How Does Earth's Rotation Affect GNSS Orbit Computations?

by Mark Petovello, April 5, 2018, Inside GNSS

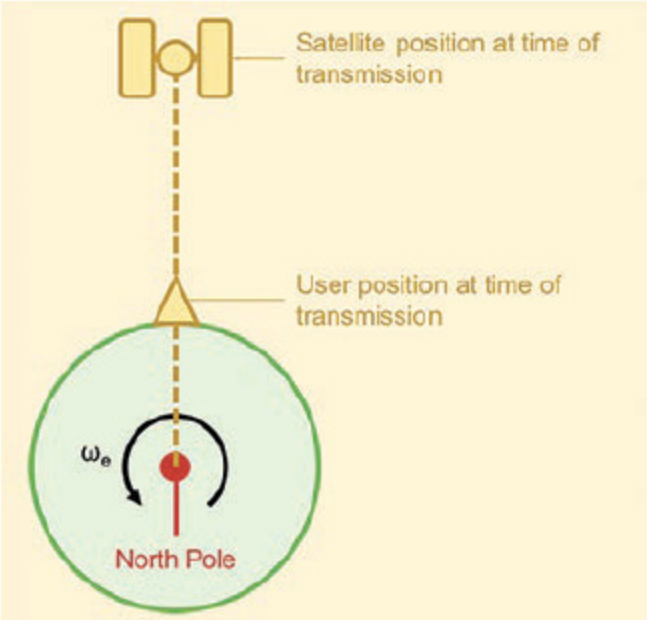

FIGURE 1 Example of a user located directly below a geostationary satellite, as viewed looking down on the north pole. The diagram assumes that this is the situation at the time of signal transmission. Diagram is not to scale.

GNSS positioning is premised on the idea that the satellite positions are known, or can be calculated. Errors in the computed satellite position will manifest as ranging errors that degrade the positioning accuracy.

It is important, therefore, to ensure satellite orbit calculations are as accurate as possible. As discussed in this article, Earth rotation plays a key role in this regard but surprisingly few references on orbit calculation actually mention its affect explicitly or how to compensate for it. Don't fret, however, the correction is certainly applied or positioning accuracy would be much worse than is currently attained.

Reference Frames

Earth rotation is important because of the choice of reference system in which orbital calculations are performed. In particular, GNSS orbits — either from the broadcast orbital models or precise post-mission estimation — are parameterized in an Earth-Centered Earth-Fixed (ECEF) coordinate frame such as the WGS84 reference frame used for GPS.

A common definition of an ECEF frame is one whose z-axis is the rotational axis of the Earth (pointing north), whose x-axis is in the equatorial plane and includes the median passing through Greenwich, and the y-axis completes the frame (typically in a right-handed sense). By definition,such a frame rotates with the Earth and is thus time-varying in inertial space with a period of 24 hours.

In the context of satellite position computations, this means that satellite locations can be computed at any given time, in an ECEF coordinate frame that is valid at that same time.

An easy way to visualize this point is to consider an ideal geostationary satellite whose position relative to the Earth does not change over time — orbital parameters or orbital files would always yield the same coordinates for the satellite.

Effect of Earth Rotation

So where does Earth rotation enter the picture? Well, precisely from the fact that the time at which a satellite transmits a signal, and the time a receiver receives that signal differs. Between the time of transmission (tt) and the time of reception (tr) — roughly 70 milliseconds (give or take few milliseconds) for medium-Earth orbiting (MEO) satellites — the Earth has rotated by $\omega_e . (tr - tt)$, where ω_e is the rotation rate of the Earth.

To illustrate the effect of this, we return to our idealized geostationary satellite. We further consider a user located directly below the satellite. **Figure 1** shows this situation looking down on the north pole. To simplify later discussions, we consider this figure to apply at the time of signal transmission.

(continued on next page)

How Does Earth's Rotation Affect GNSS Orbit Computations?
(continued)

Since the orbital radius of a geostationary satellite is known (approximately 42,164 kilometers) and the radius of the Earth is known (approximately 6,371 kilometers) the separation of the user and satellite at any given instant is constant and can be easily computed.

Now consider **Figure 2**, which shows the same figure but also includes the location of the user and satellite at time of signal reception. Because of Earth rotation, the signal travels the path denoted by the blue line, which is obviously longer than the instantaneous separation of the satellite and user. This is the path in inertial space (ignoring the Earth's orbit around the sun for simplicity).

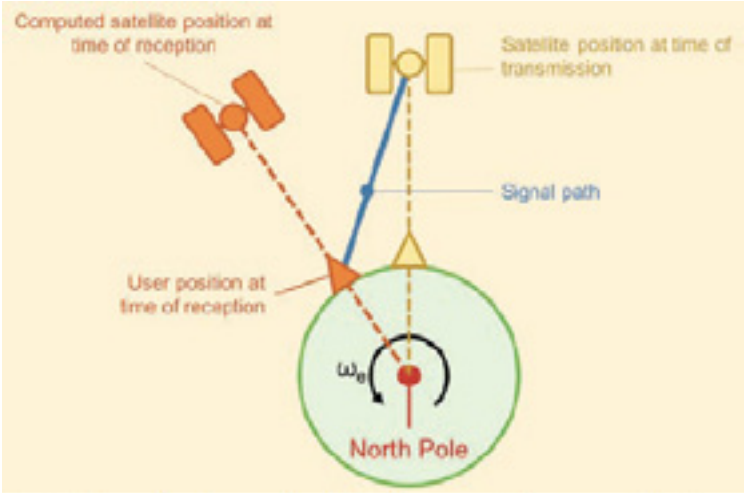

FIGURE 2 Example of a user directly below a geostationary satellite at time of signal transmission and signal reception. Since the signal travels from the satellite's position at time of transmission and arrives at the user's position at the time of reception, the actual distance traveled (blue line) is longer than the instantaneous separation of the two bodies. Diagram is not to scale.

The problem, however, is that because orbits are parameterized in an ECEF frame, the computed position of the satellite will still be directly above the user. This leads to a situation where the true signal path and the computed signal path differ. Unless accounted for, this difference will manifest as a ranging error in the receiver's position engine, which computes the difference of the measured and predicted signal paths (i.e., ranges). The magnitude of the position error depends on the number and distribution of satellites, as well as user latitude. As an example, in Calgary, Canada, ignoring Earth rotation results in a shift in the estimated user position of about 20 meters, primarily in the east/west direction.

Before moving on, although we used the example of a geostationary satellite, the exact same effect applies to non-geostationary orbits as well. The main difference is that the satellite positions in Figures 1 and 2 would not necessarily be directly above the user, and the distance between the user and satellites, projected into the equatorial plane (which is shown in Figures 1 and 2), will vary with time as satellites move along their orbits. The good news is that regardless of the orbit, the method of compensation is the same.

Simple Solution

To remove the discrepancy between the measured and computed signal paths, we need to compute the ECEF position of the satellite at the time of transition in the ECEF frame at the time of signal reception. Fortunately, this is easily accomplished by realizing that the two coordinate frames are related by a rotation about the z-axis.

Mathematically, we can write

$$\vec{r}_r = R_3\left(\omega_e \cdot (t_r - t_t)\right) \cdot \vec{r}_t$$

where is a position vector at the subscripted time (or frame), and R3 (ω . (tr – tt)) is the rotation matrix about the z-axis by the angle subtended by the Earth rotated during signal propagation.

Applying the transformation in (1) yields the position of the yellow satellite in Figure 2, which allows for the proper computation of the (orange) user position.

The astute reader might be wondering how the propagation time is computed. This can be found by iterating to a solution: first, assume an initial distance between the user and satellite (e.g., 70 milliseconds); then compute the satellite position using this assumed distance (for Earth rotation compensation); use the approximate user position to re-compute the range to the satellite; and finally use this range to compute the satellite position.

The accuracy of the user position in the iteration is not typically a problem. The reason is because, even with a position error of 10 kilometers, the worstcase propagation time error would be 33.3 μs (i.e., 10 km / 3e8 m/s). Multiplying this by Earth rotation rate (~7.3e-5 rad/s) yields an angular error of about 2.4 nanoradians. Even over an orbital radius of 26,000 kilometers (assuming a MEO orbit), the orbital error is less than a decimeter. Then, of course, after the first epoch, the position error is typically several orders of magnitude smaller making the effect of user position error negligible.

Summary

This article has shown why Earth rotation needs to be accounted for when computing satellite coordinates for GNSS applications. The compensation is simple but crucial steps for obtaining the highest possible positioning accuracies.

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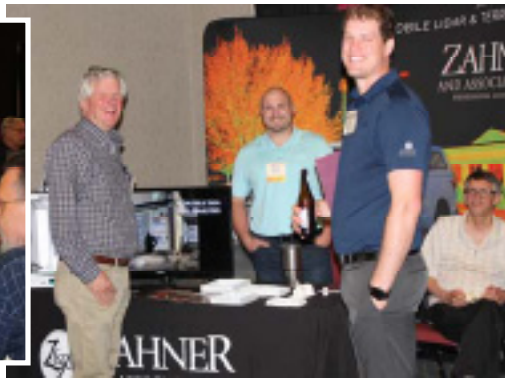





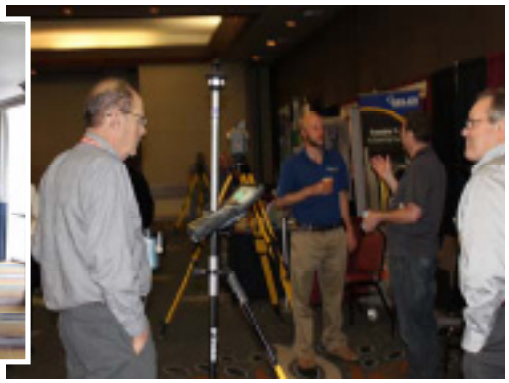

Drones (Photogrammetry) vs Terrestrial LiDAR – What Kind of Accuracy Do You Need?

by Jonathan Barnes, April 18, 2018, Commercial UAV News

How accurate does the information you're gathering need to be? What does survey-grade accuracy really mean? Will gathering information that fits this description make a difference for your project?

These are just a few of the questions that professionals working in industries that range from construction to mining to oil & gas deal with when it comes to evaluating the merits of capturing 3D data using a drone equipped with only a camera (photogrammetry) versus using a terrestrial laser scanner. It's absolutely possible to mount a laser scanner on a drone, but for the purposes of this discussion, we're focused on what it means to compare photogrammetric data captured in the air via drone with LiDAR data captured via a ground-based laser scanner.

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What Kind of Accuracy Do You Need? *(continued)*

While survey professionals have historically relied on terrestrial lidar to gather actionable info, drone photogrammetry solutions are increasingly capable of gathering data that professionals require. Does that mean we'll soon see the death of laser scanning?

Traditionally, the main challenge with laser scanning adoption was cost. Those costs are a major discussion point in the photogrammetry vs LiDAR argument, mostly because in this type of comparison, LiDAR is still more expensive, even though the technology is now more affordable than ever. As people on both sides of that debate will tell you though, costs really shouldn't be driving the decision, because the limitations and strengths of each technology should be the essential focus. Those inherent strengths are just part of the reason we're nowhere near seeing the death of the laser scanner, and why most professionals talk about the importance of defining the accuracy you need on a given project before discussing one solution over another.

Since the question remains whether survey-grade information is absolutely necessary, most professionals concede there's no silver bullet solution. Just like comparisons of drones with manned aircraft and satellite solutions, what makes sense is going to depend on what it will mean to serve the clients' needs as well as possible, and the best answer can even be a combination of these technologies. That said—there are some good rules of thumb to keep in mind when it comes to decisions about staying on the ground or taking to the sky.

Choose Drone/Photogrammetry When…

When the area to be surveyed is large and outdoor, it's often best to use a drone for the job.

Drone technology can cover a large area with a single unit and a few batteries. That area can be exponentially expanded with a few units, but there are limitations in terms of scale. Such an application is good for an area that is hundreds of acres in size, but it's not going to be the best approach for an area that's hundreds of miles in size.

Choose Terrestrial LiDAR When…

When a high degree of accuracy is important, terrestrial LiDAR is oftentimes the best choice.

As an example of this, consider the archeological survey of an area containing Mayan ruins, explains says Dan Hubert, owner of Modus Robotics. "They might take an approach of using LiDAR [attached to a plane] flying over the top of the ruins, to get through the vegetation, to see where that civilization's remains are."

How does terrestrial LiDAR tie-in? They can be the right choice when you need a detailed look at this kind of site. After a LiDAR-equipped plane makes its flyover, professionals might want to get minute detail on a part of the topography surveyed. For that kind of detail, it can make sense to employ a terrestrial scanner, which will provide detail down to the 1 millimeter-level.

"Now you have a historical document that you can load into an archeological or GIS database," Hubert says.

Choose Drone/Photogrammetry When…

There are times when it makes more sense to add a drone to the process you already employ. That said, a firm must know whether it's logical to use a drone or not for a given

situation, otherwise trying to integrate one can create unnecessary confusion.

"Is drone data collection going to help?" Hubert asks prospective clients. "And how might data automation get you a competitive advantage?"

Much of this goes back to the question of how accurate the data being gathered needs to be, and it's one that needs to be asked and answered at the beginning of any project.

Choose Drone/Photogrammetry When…

Drones meet or exceed expectations of delivery of data.

"People are using Part 107 to find savings that reduce walk time, and which allows skilled labor to go to an executable skilled labor job, rather than to an inspection job," Hubert says.

Choose Terrestrial LiDAR When…

The job calls for contour mapping. Some jobs require it, and a drone isn't necessarily equipped to provide such detail.

Choose Drone/Photogrammetry When…

Obstructions are in the way. If a job requires mapping around a power line or another obstruction, sometimes drones are just the right tool for the job. Ground-based laser scanners often can't handle such tasks as efficiently as drones.

Choose Terrestrial LiDAR When…

It is required by job specifications. However, consider how information gathered via drone could create a new value proposition.

Mapping below a tree canopy or another obstruction requires LiDAR, and clients will often mandate this approach. However, similar mandates might exist for a transmission line job, and there's an opportunity to utilize a drone in this circumstance. It's all about the right tool for the right job, and more and more that means utilizing drones and terrestrial laser scanners together.

About the Author Jonathan Barnes

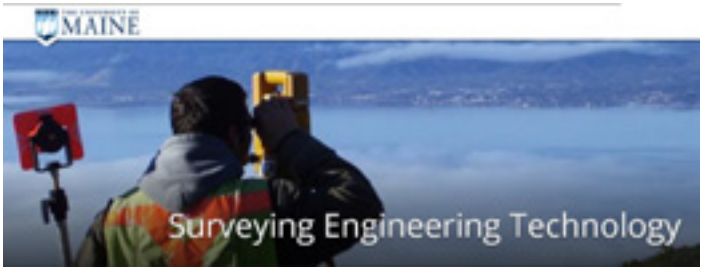
Jonathan has written about drone cargo ships for Rolls-Royce, about the use of drones to bring Web connectivity for Facebook, and about drones used in mining, construction and elsewhere for Kespry. A longtime Engineering News-Record (ENR) contributor, he's helped the magazine win three American Society of Business Publication Editors awards for reporting and writing. He has written about construction tech for ENR, BuiltWorlds and Cadalyst, and for corporations including Procore, ARC Document Solutions and others. A longtime freelance journalist and tech writer, he's contributed to Fortune, Reuters and other media, and has reported for the Wall Street Journal and New York Times. He earned a BA in Professional Writing and Creative Writing from Carnegie Mellon University.

What's New with Surveying Education

by Knud E. Hermansen, P.L.S., P.E., Ph.D., Esq.

I believe informing survey practitioners about the efforts to educate future surveyors is important. Sharing information is necessary for a productive partnership between practitioners and educators.

In a previous article I have discussed the University of Maine's effort to offer dual degrees, and an on-line education option. The University of Maine is not unique in these efforts. Many surveying programs are pursuing these and other options.



In this article, I would like to provide some insight into the means and methods I use to provide distance education. Before explaining these means and methods, I will state that it is my opinion that the traditional classroom is superior to the learning methods I will describe. In the traditional classroom, the interaction between the student and instructor provides immediate visual and verbal interaction and feedback. Oftentimes, for the 18-22 year old student, the compulsory attendance in a scheduled class is a necessary requirement in order to create an effective learning environment.

Technology and software have allowed faculty to record lectures, integrate audio and visual stimulations, and animate the visual display. Technology and software have allowed faculty to produce videos on a variety of topics.

To date I have prepared over 116 videos. My colleagues in surveying education have created many more. In only one of the 116 videos is my face shown. These videos are not the 'talking head' video comprised of a video taken of a classroom presentation.

Currently, I use Camtasia software to produce education videos. Once the video has been prepared on Camtasia, I convert the video to mp4 format and upload the video on to YouTube. The YouTube address is sent to students who can enter the address into their web browser and view the video.

Students can ask questions via e-mail or using Zoom software. Zoom software allows face-to-face viewing and conversations much like a Skype connection or Go-To-Meeting software. Zoom allows the entire class to interact with each other and with the instructor.

Exams are scheduled on Blackboard software. The exam is scheduled for a certain date and time period. My exam questions are composed of multiple-choice, multiple answer, and true/false questions. The exam format is very similar to the fundamentals of surveying exam and the principles and practice surveying exam. Question and answer choices are scrambled so that students sitting side-by-side will not likely see the same question at the same time. Even if two students view the same question at the same time, the correct answer to the same question will be in a different order for each student.

There are three general formats for the videos that I prepare. The format depends on the course content. Some courses are predominantly computation or design courses. These videos will display nomenclature, equations, constants, coefficients, and sources for variables followed by example calculations.

The video I prepared explaining vertical curves is an example of this format. The equations and the equation development for vertical curve equations are presented in one video. (https://youtu.be/vZ1Xwpozax0) In another video, the vertical curve equations are applied using an example. (https://youtu.be/o2cw5nDY4do)

The second format is used to explain the realities of surveying practice. Background, scope, and matter-of-fact aspects of practice are presented in this video format. The format usually shows an example explaining the procedure along with suggestions, explanations, and practical advice. The video on public record research is an example of this format. (https://youtu.be/rt1BIU0s5YM)

The third and final format I employ is used for explaining legal doctrines and principles that must be utilized by surveyors. The video is an explanation on how the doctrine

or principle applies in a particular situation. This video format explains the elements required for the doctrine and application of the doctrine or principle to be employed by the surveyor. A video explaining practical location is an example of this format. (https://youtu.be/FSLmUoi7H08)

The near future will bring many more changes and innovations used for the education of surveying students and practitioners. If you want to receive information on earning a surveying degree by taking on-line courses, always contact your local or regional surveying program first. The local surveying program will offer a quality education at a reasonable price. If you don't have a local or regional program offering what you need, contact Dr. Raymond Hintz at the University of Maine. (Raymond.Hintz@maine.edu)

Mark Your Calendar

61st Annual Meeting and Convention

October 3-6, 2018

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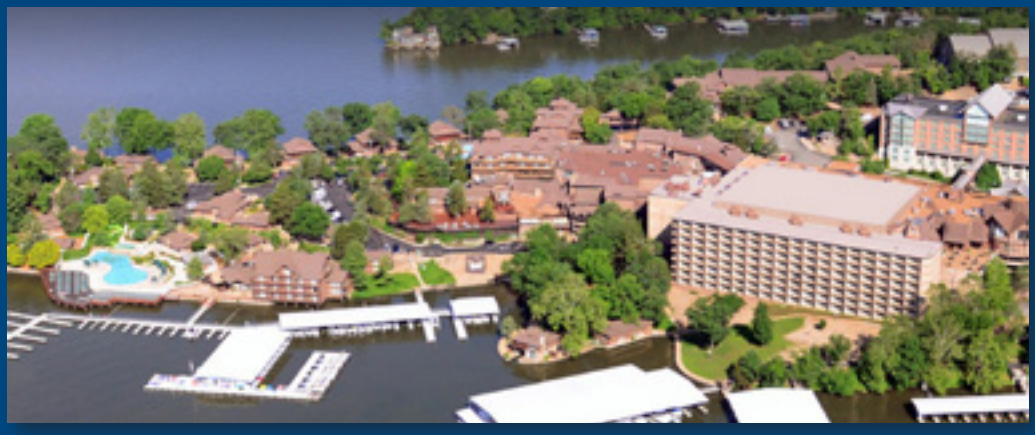

News from the National Geodetic Survey

Thursday, May 17, 2018

New Robot Arm Calibrates Navigation Satellite Antennas

NGS installed a new robot arm to conduct absolute calibrations for Global Navigation Satellite System (GNSS) antennas. NGS's Antenna Calibration Program provides calibrations for specific antenna codes used to process GNSS data in NGS products and services. The new robot performs calibrations with higher accuracy and faster data-collection times for more satellite systems than earlier equipment did. Without a calibration, the antenna introduces errors. Antenna calibrations must be used when processing data for high-precision and high-accuracy applications, such as floodplain mapping. NGS also provides GNSS antenna calibration services for eligible antennas to the public free of charge.

Friday, May 11, 2018

Planning for Modernizing the National Spatial Reference System

NGS hosted a workshop with commercial equipment and software representatives to gauge their needs and concerns for Modernizing the National Spatial Reference System in 2022. The workshop facilitated an exchange of information between NGS technical experts and their industry counterparts. Collaboration between NGS and commercial firms is important because many end users use the NSRS in commercially available software packages. NGS will share information about the topics discussed and preliminary outcomes from the workshop in a webinar scheduled for June 7.

Friday, May 04, 2018

Survey Professionals Discuss the Industry's Evolving Mission

NGS participated in the American Society of Civil Engineers' Utility Engineering and Surveying Institute 2018 Surveying and Geomatics Conference in Pomona, CA. The event brought together survey professionals to discuss significant issues related to the future of the industry. NGS presentations included discussions on upcoming changes and new concepts related to the datums planned for release in 2022, among other topics.

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Thursday, April 26, 2018

Public Comments Sought for State Plane Coordinate System

A Federal Register Notice (FRN) invites public comment on draft policy and procedure documents for the State Plane Coordinate System of 2022 (SPCS2022) by August 31, 2018. The goal is to ensure that SPCS2022 is technically correct, consistently defined, and meets the needs of NGS customers. The FRN documents propose SPCS2022 characteristics and the process for contributing to their development. It also seeks input on whether additional "special-purpose" zones should be part of SPCS2022. The zones are intended to provide contiguous and appropriate coverage, especially in areas that are split across two or more zones. The State Plane Coordinate System supports surveying, engineering, and mapping activities throughout the United States and its territories.

Thursday, April 19, 2018

Commerce Department Bronze Medal Awarded to NGS Staff

Members of NGS's Remote Sensing Division received the Commerce Department's Bronze Medal for collecting and disseminating damage assessment imagery in the aftermath of Hurricane Matthew. The team collected more than 11,000 image frames covering 5,600 square kilometers, and quickly made these images available to federal and state partner organizations and the public. These processed images were used to assess storm damage and plan recovery efforts. The award-winning team also included members of the Office of Marine and Aviation Operations.

Friday, April 06, 2018

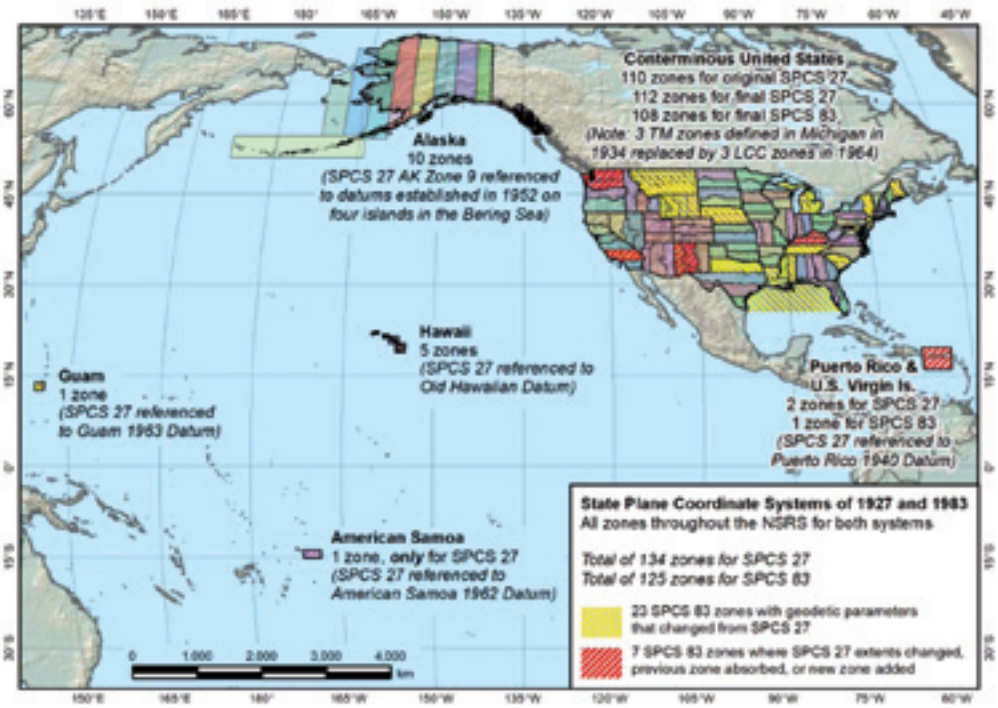
NGS Participates in Inaugural Global Surveyors' Day

An NGS geodesist and licensed surveyor represented NGS at the inaugural Global Surveyors' Day in Washington, DC. Discussions centered on the essential functions of surveyors in society, both past and present, with a particular emphasis on how surveying can best adapt to a changing world. Looking to the future, experts discussed broadening education to embrace allied fields and emphasized the importance of ethics, effective communication, raising public awareness to improve the image of surveyors, and attracting more young people to the profession.

Thursday, March 22, 2018

State Plane Coordinate System Report and Training Materials are Available

The State Plane Coordinate System (SPCS) is a system of large-scale map projections created in the 1930s to support surveying, engineering, and mapping activities throughout the U.S. and its territories. As part of its modernization of the National Spatial Reference System in 2022, NGS will adopt a new SPCS. To aid in the transition, NGS published a special report, The State Plane Coordinate System: History, Policy, and Future Directions (PDF) , that provides context for SPCS 2022. Additionally, NGS created a collection of web pages to help users learn how the SPCS will change in 2022 and how to use it. Finally, NGS launched a series of educational webinars to inform stakeholders of the reference system changes and how they can get information when using the SPCS in the future.



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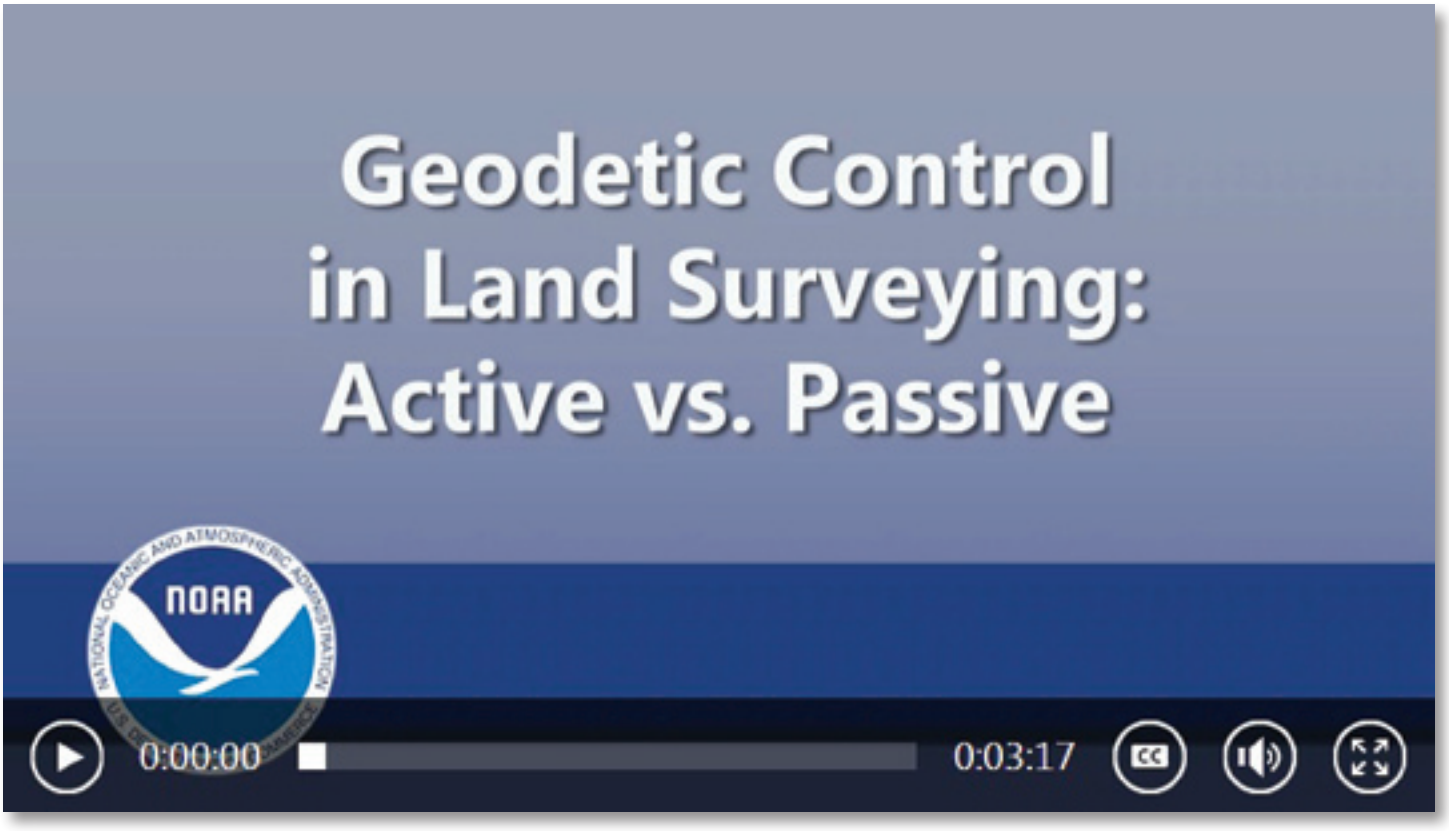
Thursday, March 01, 2018

NGS Launches its Latest Online Educational Video

NGS recently published its latest educational video geared toward surveying, mapping, and remote sensing professionals. The short video *Geodetic Control in Land Surveying: Active vs. Passive*, is an example of NGS's commitment to providing educational resources pertaining to the National Spatial Reference System, as well as information about other products and services. NGS, in partnership with The COMET® Program-a worldwide leader in support of education and training for the environmental sciences-has developed a library of videos on geodesy and mapping topics, all of which are available to view or download



Thursday, February 22, 2018

Televised Report Illustrates Impact of Improved Elevations

An NBC News affiliate television station in Denver, CO, aired a report on the national and local impacts of modernizing the nationwide system of precise heights, which will be implemented in 2022. Reporters visited NOAA's Table Mountain Geophysical Observatory near Boulder to learn how ultra-precise gravity measurements at the observatory and NGS's GRAV-D project are expected to affect published elevations throughout the United States. While Denver is in no danger of losing its mile-high nickname, updated elevations may affect Colorado's claim to having 54 mountain peaks with an elevation of at least 14,000 feet, as reported in travel guidebooks and climbing websites. Televised reports like these help people understand how improved observing methods and more accurate elevations can impact their everyday lives.

Thursday, February 15, 2018

NGS Coordinate Conversion and Transformation Tool (NCAT) Released

NGS released the *NGS Coordinate Conversion and Transformation Tool (NCAT)*. The new tool combines several previously separate tools into a single browser-based user interface, which supports single-point and multi-point conversions, web services, and downloadable software. NCAT allows users to easily convert geodetic coordinates among different coordinate systems, transform coordinates between different datums in a single step, and get local error estimates for each transformation. The one-stop tool improves access to the National Spatial Reference System for a multitude of geospatial applications; enhances the efficient use of NGS positioning products; and makes it convenient to convert and/or transform coordinates for a variety of geospatial applications. It is available as web service and can also be downloaded for offline processing.

Thursday, February, 01 2018

NGS Supports CO-OPS's Use of Global Navigation Satellite System

NGS and CO-OPS met regarding the Global Navigation Satellite System (GNSS) and its use in documenting the position of tide gauges. The meeting had particular significance for engineering applications as they pertain to tidal datums. NGS provided information on topics including its Online Positioning User Service (OPUS), data processing, and data management. The processing and analysis of continuous GNSS data is new to CO-OPS. As CO-OPS transitions to using GNSS technology as its primary means for vertical control, both program offices will leverage their partners to support the development of new methodologies for analyzing vertical control at water level stations.

Thursday, January 25, 2018

NGS Releases NOAA Ocean Podcast, Geodesy: The Invisible Backbone of Navigation

The National Geodetic Survey and NOS Communications and Education Division released the latest NOAA Ocean Podcast, *Episode 12, Geodesy: The Invisible Backbone of Navigation*. Geodesy is the science of accurately measuring and understanding the Earth's geometric shape, orientation in space, and gravity field. It's the reason we know where we are, and enables us to make maps of where we are and where we want to go. In this episode, listeners learn how this science with an unfamiliar name shapes much of what we do every day.

NSPS NEWS & VIEWS
National Society of Professional Surveyors

NSPS Participates in Congressional Roundtable on Workforce Development

As a member of NSPS, a member of the Board of Directors of the Maryland Society of Surveyors, and currently serving as Chairman of the Workforce Development Committee of MSS, Bryan Haynie represented NSPS during a Congressional roundtable on Workforce Development hosted earlier this week by the Smart Cities Caucus, co-chaired by Reps. Yvette Clarke (D-NY) and Darrell Issa (R-CA).

The Caucus serves as a bipartisan group of Members dedicated to bringing American communities into the 21st Century through innovation and technological change. The roundtable was moderated by Spencer Overton, President of the Joint Center for Political and Economic Studies.

NSPS Participates in Congressional Briefing on NOAA's Digital Coast

NSPS Government Affairs Consultant John Palatiello provided remarks last week at an event on Capitol Hill in Washington, DC in support of NOAA's Digital Coast project based in Charleston, South Carolina. His remarks focused on the Digital Coast data that are utilized and applied by Professional Surveyors. NSPS has long supported the Digital Coast and leads the coalition supporting legislation codifying the project into a Congressionally authorized program.

XXVI FIG Congress, Istanbul, Turkey — May 6-11, 2018

The XXVI FIG Congress opened Sunday, May 6th in at the Istanbul Congress Center in Istanbul, Turkey. Over 450 presentations in 111 sessions will be presented during the Congress week.

Several pre-Congress sessions were on Saturday, May 5th on BIM and Reference Frames as well as the 4th FIG Young Surveyors Network Conference which had 120 young surveyors from around the world in attendance.

NSPS is bidding to host the 2022 FIG Congress. Our proposed venue is Walt Disney's Swan and Dolphin Resort in Orlando, Florida. The last time an FIG annual conference was held in the Western Hemisphere was 2002. In 2022 it will have been 20 years since the 2002 Congress. Time to hold another FIG Congress in our part of the world! The competing site is Cape Town, South Africa. Our bid presentation was made on Sunday during the first day of the FIG General Assembly. Voting to select the 2022 site will be held during the second session of the General Assembly on Friday, May 10th. Fingers crossed!

Attendees from NSPS include Bob Foster (Honorary FIG President and Past ACSM President), Allen Cheves (Publisher, The American Surveyor), Steve Nystrom (Chair, FIG Commission 9- Valuation and the Management of Real Estate), Kevin Ahlgren (NGS), Dan Roman (NGS, incoming Chair of FIG Commission 5- Positioning and Measurement), Curt Sumner (NSPS Executive Director), John Hamilton (NSPS Delegate to FIG Commission 6- Engineering Surveys), Brent Jones (Esri), Jon Warren (Past NSPS President) and John Hohol (NSPS Head of Delegation and FIG Honorary Member).

2018 NSPS National Student Competition

Carl CdeBaca, Editor, The Nevada Traverse, and NSPS Director- Nevada

The 2018 National Society of Professional Surveyors' National Student Competition took place in conjunction with the NSPS spring meetings as part of the Western Regional Survey Conference in Las Vegas, Nevada at the Luxor Hotel and Casino. The conference, a joint affair between NALS, UCLS APLS and WFPS took place over the week of February 18 thru the 24th, with the field exercise portion of the Student Competition on Sunday February 18 being the first activity. This year's group of competitors included the Northeast Wisconsin Technical College, Idaho State University, Utah Valley University, California State University – Fresno, East Tennessee State University, Texas A&M University Corpus Christi, Northern Illinois University, University of Akron, New Mexico State University, Oregon Institute of Technology, University of Puerto Rico at Mayaguez, and Great Basin College.

The winning team from Oregon Institute of Technology.

All 12 teams with their Advisors.

The night before the field exercise, the teams met to find out the nature of the competition this year. It has been several years since this competition had a legitimate field component and it was nice to see the spirit of head-to-head competition back in the contest. The precise details of the competition, and what tools would be available to the students has been a closely guarded secret. The predetermined theme was that the competition would be similar to an 'Engineers Without Borders' mission, so the teams were prepared to travel light and work with less-than-optimal equipment. As competition coordinator Rich Vannozzi revealed the exact nature of the competition, it turned out the teams would only be able to utilize steel tapes, and auto-levels plus accessories like rods and tripods, and a compass.
Read more at http://www.multibriefs.com/briefs/nsps/student050218.pdf.

(continued on next page)

Should you hire a land surveyor?

The NSPS Public Relations Committee has developed a new brochure for use by members to assist in providing information to the public regarding instances in which a Surveyor should be hired, tips on hiring, how Surveyors do their work, and what to expect from a Surveyor. To view the content of the brochure, check it out online at http://www.multibriefs.com/briefs/nsps/hiring050218.pdf. Copies of the brochure will be available soon by contacting Trish Milburn (trisha.milburn@nsps.us.com) at NSPS headquarters.

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Reminisce of An Old Surveyor, Part III – Other Equipment

by Knud E. Hermansen, P.L.S., P.E., Ph.D., Esq.

This is the third and last article on surveying equipment and procedures that are now relegated to history. I have been surveying for around half a century. I started before electronic distance measuring was common. Transits and steel tapes were the prevailing equipment found in a survey firm. Metal detectors were rare. As a result, I have had experience with surveying equipment that will never be used again by the modern surveyor.

My two previous articles have discussed taping, the compass, and the transit. I shall now delve into other procedures and equipment known and used in historical surveys of which I often took part.

Plane Table – In the early mapping surveys I often participated in, we used the plane table and alidade to prepare a site map and topographic map while in the field. In the days before computers, the plane table was an excellent tool to prepare an accurate map in a hasty manner. I have been told that almost all the soil maps prepared in the 1920s and 1930s were done using the plane table and alidade. I had not made my debut on the surveying field at this time so I have no first-hand knowledge of the accuracy of this information.

The plane table was a large board, the dimensions of which I can no longer remember. It was the size of a typical drawing board that engineering and surveying students once had to purchase when studying in their major. This board was mounted on a tripod. The board came with the tripod mounting ring fastened to the underside of the board. The mounting ring was of a size that was equivalent to the transit mounting ring. The board, once mounted on the tripod, was set up at waist level. There was no attempt to plumb this over a known station though I suppose there were situations when this should be done. It was possible to do so.

A large sheet of paper was fastened to lay flat on the top of this board using tape or tacks. The alidade was then placed on the board, atop the paper. I suppose an alidade could be described as a transit scope fastened to a flat scale – the scope being above and parallel to the long length of the scale. Somewhere on the scale was a bubble that was used to level the drafting board or plane table.

With the plane table leveled, a long shanked pin was inserted through the paper into the board. The represented the observer's position. The mapping of the area could now begin.

The rodman, armed with a stadia board, would hold the stadia board at a point to be located by the person at the plane table. Using the stadia hairs apparent when viewing through the scope in the alidade, the distance from the alidade to the stadia board would be determined. On the plane table, the scaled distance would be measured from the long-shanked pin along the edge of the alidade where a point would be marked and labeled on the paper. The orientation of the scale's edge on the alidade being the same direction as the scope is pointing. This procedure was repeated numerous times until the surveyor was satisfied the paper fastened to the plane table was complete with the information necessary for the map being produced on the plane table.

Elevations could be obtained by the simple expediency of setting the alidade level using a scope bubble for this purpose. Most alidades had a plate and Vernier to read a vertical angle that would allow the elevation to be determined by trigonometry. Many alidades had what is known as a Beaman scale that would allow calculations without having to look up trig values. I will omit discussing the Beaman scale and how it was used. In truth, I would be rather rusty in remembering how to use it after more than four decades without practice.

The end result is that the survey crew returned to the office with a completed map of the area often including contour lines. The only consistent fault I found with the plane table was the fact that survey work on a hot summer day using a graphite pencil often left the map sheet covered with smudges.

Stadia Board – I have mentioned the stadia board when speaking of using the plane table. The stadia board can be visualized as a level rod with much larger graduations. The stadia board was somewhat wider than a level rod in order to accommodate the larger graduations. The larger graduations allowed for seeing the rod at longer distances.

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Capitol View

A look at surveying legislative matters

by Mo McCullough

The 2018 Legislative session came to an end at 6:00 p.m. on May 18 and despite all the distractions coming from the Executive branch and the problems for Gov. Eric Greitens, this session was one of the most productive sessions in many, many years. The problems going on at the Capitol with the Governor worked to bring together the leadership in both the House and the Senate as no one truly expected. There were 2,068 bills introduced -- 558 in the Senate and 1,510 in the House. The legislature passed 144 bills including 20 separate measures that make up the state's annual budget. The Governor has already signed a few measures and the rest will eventually go to whoever happens to be occupying the office at the time.

The language of HB2231 which was Robert Ross's legislation removing the three letters of recommendation requirement was amended to SB843 and HB1719, both of which were truly agreed and finally passed. All language dealing with "fund sweeps" with registration boards and commissions were dead by the end of the session.

There were several prevailing wage bills out there - none of which made it across the finish line.

For further information, go to www.house.mo.gov or www.senate.mo.gov

Reminisce of An Old Surveyor *(continued)*

I suppose reading stadia distances is a lost art. It was a rather simple procedure unless there was trig involved. The difference in the rod readings between the upper stadia wire or hair and lower stadia hair was obtained and multiplied by 100 giving the distance in feet, assuming the stadia board was so marked in feet and decimal parts of a foot. I will confess to reading the stadia rod at ranges that I could only read half of the stadia rod – that is using only the center wire and top wire or bottom wire. In such cases the interval between the middle and upper or lower stadia hair was multiplied by two before multiplying by 100.

In theory if the stadia rod could be read to the nearest 0.01 of a foot, the horizontal distance could be calculated to the nearest foot. Conversely, if the instrument operator made an error reading of 0.01 of a foot, the horizontal distance would be in error by a foot. This precision was acceptable for most mapping projects.

I will say that I met more than one old surveyor that laid off subdivision lots using stadia to the annoyance of the modern surveyor who finds the distances between corner monuments varying by as much as two feet with no consistency in the error that would allow a dependable deficiency or an overage to be applied when retracing the lot boundaries. Perhaps I have solved a mystery involving some old subdivisions and corners found.

Heliotrope – I will comment briefly about the heliotrope though it's use in private practice was very limited. The heliotrope was an elongated target, fasted to a tripod, and plumbed over a point. The heliotrope I used was composed of two rings along the elongated board with a mirror at the end farthest from the instrument observing the heliotrope. One heliotrope I used actually had two mirrors that allowed the sun's light to be bounced from the sun using the first mirror of the heliotrope to the mirror in the back of the heliotrope that then reflected the sun's beam through the two rings to the observer. The double mirrors was required if the sun was behind the heliotrope as it was pointed toward the instrument. The rings in the heliotrope were aimed at an observer standing behind an instrument that was being used to measure angles. The mirror at the rear was adjusted to reflect the sunlight down through the rings toward the instrument operator producing a bright light for the observer to aim upon. Given the sun's apparent movement, the person at the heliotrope had to continuously adjust the mirror. I was always impressed that when standing at the instrument, I could see the bright light reflected by mirror on the heliotrope for up to 30 miles away in some cases.

Subtense Bar – I suppose the subtense bar I used from time to time was more common than a heliotrope in private practice but not by much. The subtense bar appears as a much shortened level rod rotated from the vertical to be horizontal or roughly parallel to the ground. The subtense bar was mounted in its center on to the top of a tripod. The tripod was centered over a traverse station or control point. From one end of the bar to the other was a known distance. The subtense bar that I used had a sight tube in the center. The bar was rotated about the tripod top until the sight tube was centered on the instrument operator. This would put the length of the subtense bar perpendicular to a line between the subtense bar and instrument. The instrument operator would measure the angle between the ends of the subtense bar. Using trigonometry, the distance between the instrument and subtense bar could be calculated. The accuracy of the distance was a direct function of the accuracy in measuring the angle. The subtense bar was a very useful tool in measuring those distances that could not be taped. I would often use the subtense bar in measuring distances across water bodies. I also used it from time to time when I did not have an extra person to help me tape the distance.

Plumb Bob – I will repeat my statement from my first article and say that I don't believe a plumb bob can be found among the equipment of the modern surveyor. The plumb bob was necessary for taping. It was necessary to hang the plumb bob under the tripod in order to place the instrument over the point, there being no optical plummets on survey equipment at the time. Finally, the plumb bob was required to give back sights and fore sights over marks and monuments in the field. I have heard of more than one employer that docked the pay of an employee that forgot to bring their plumb bob to the field.

The use of the plumb bob would seem rather easy but it was not. Consider my previous explanation on the use of the plumb bob when taping. Hanging the plumb bob under the tripod to allow the instrument to be centered over a

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eBee

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The **professional mapping** drone

mark required the person to have mastered the art of a slip knot. A slip knot allowed the plumb bob to be raised or lowered depending on the adjustment of the tripod legs and how close over the mark was necessary to aim the point of the plumb bob. To use other than a slip knot caused a knot to be left in the string. A knot in a plumb bob string was a crime commiserate with wanton destruction of property.

The person had to be adept at wrapping the string around the head of the plumb bob. The wrapped string was fastened in such a manner that a tug at the string's end would unwind the string without leaving a knot. Many surveyors purchased gammon reels that alleviated this task.

Leroy Set – I will depart from surveying equipment in this one instance to speak of the LeRoy set. While it may not be classified as surveying equipment, almost every surveying firm had a LeRoy set unless the firm had a person gifted with beautiful handwriting.

The LeRoy set was a lettering set using lettering templates and a scriber. The scriber had three arms. One arm went into a long slot on the lettering template. A second arm went to a pin that followed the indent of the letter or number in the lettering template. The third arm held a pen that would ink the letter or number on the paper, mylar, or vellum. The letter templates came in different sizes, fonts, and styles. I spent many hours using a Leroy set. Probably a quarter of that time was spent getting the ink to flow smoothly out of the pen. I may have exaggerated this time a little. Getting ink to flow was an art that usually involved ink on the tongue and lips not to mention scattered across the vellum or myler. This reminds me that another quarter of the time was spent removing ink that did flow out of the pen but in the wrong location or too copiously on locations without enough pounce. Enough said on that topic as it brings back many frustrating moments.

Chain – I will admit to only using a chain one time. I would be perceived as really ancient had I admitted to frequent use of the chain – so I won't do so. For those surveyors that have never seen a surveyor's chain, the surveyor's chain does not appear like the chain an individual would find in a hardware store. The links in the surveyor's chain are approximately 7.92 inches. Each link is a length of wire with a loop at each end of the wire shank that connects to a ring loop that connects to the loop on another similar link for the chain. A four rod chain will have four brass tags with one to four fingers. One finger is found at the one rod length along the chain. Two fingers are found at the two rod length and so on. When measuring, a surveyor would count the number of rods plus the number of links to the object measured – although many a rural surveyors simply gave the number of rods and perhaps half rods without bothering to count individual links.

While there is sag in a steel tape, it hardly compares to the large sag found when holding the chain above the ground. Furthermore, every loop in that damn chain seemed to catch and clog with sticks, grass, mud, and other debris gathered when dragging the chain along the ground. To further agitate the temperament of the user – in one case being me - the debris would somehow snag and hold two link loops together thereby doubling the chain back upon itself involving some length of the chain. If there is a log with some small appendage sticking from the log you can count on the link loop snagging that appendage. There were always some vegetation protruding from the ground that would snag the chain. Links soon stretched or even broke. Of course, these problems were all relayed to me since I can't be that old to have personally experienced the agitation caused by measuring with the chain.

Dip Needle – Metal detectors were around since World War II but their widespread use in surveying firms seemed to occur in the mid to late 1970s. Surveying without a metal detector resulted in many pin cushion corners since an existing pin or pipe that was buried to mark the corner was not always found before a new monument was set.

One trick that I often employed before owning a metal detector was to hold a compass and slowly float the compass just above the ground and look for twitches in the compass needle. This technique allowed me to find many metal corners that were just below the ground surface. In the 1960s up to the widespread use of metal detectors, dip needles were commonly used to find the buried metal corners. Dip needles were composed of a box with a long, looped strap. The box contained a magnetized needle. The box had a window allowing observation of the needle.

Using the long strap to allow the surveyor to stand up, the box was hovered over the ground while the needled was

observed. The sensitive, magnetized needle dipped when influenced by nearby metal. By this means, the surveyor could discover if there was a metal pin, pipe, or bar below the ground surface. The dip needle was not as sensitive to buried metal as modern metal detectors. I don't believe I ever found a pin or pipe that was buried more than half a foot below the ground surface using a dip needle.

EDME – Early electronic distance measuring equipment, known as an EDME or EDM, using shortened initials, were a separate item of equipment from the transit or theodolite. Often the operator would have to remove the angle measuring equipment and mount the EDM directly on the tripod. Later, the EDM and angle measuring equipment were configured so the EDM was mounted on the standards of the angle measuring instrument.

The first EDM I used was a tellurometer or cubic tape. A tellurometer was set up on both stations and pointed toward the other station using a null needle to find the optimum pointing. Each tellurometer would determine the distance between the opposing tellurometers. The two distances were averaged. The tellurometer used microwaves to determine a distance. You could switch between speaking to the other operator and measuring a distance. Distances were calculated using a paper form that I shall mention again with the next item of distance measuring equipment.

Later I used a Hewlett Packard laser EDM. With this instrument, you knew you were pointing at the reflector because you would see a bright red light as the laser light was reflected back to the instrument. That probably did not do my eyes any good. Not that standing in the path of microwaves was healthy.

Both items of equipment, the tellurometer and laser EDM, required a needle be nulled, numbers read, frequencies shifted, and an entire sheet of a paper form employed were various readings were made, entered, and manipulated. I believe the form was published by an IRS agent who first invented the 1040 long form.

Temperature and atmospheric corrections had to be hand calculated. Prism corrections were applied to every measurement of the laser EDM. It was a complicated and time consuming process to determine a distance. Yet, it was far faster and more accurate than obtaining long distances by taping.

If my memory serves me, the Guppy was the first instrument I possessed that gave a distance directly without a lot of data entry on to a form and intermediate calculations. I will not further describe this popular EDM. After the Guppy, the angle measuring and distance measuring were combined into one instrument known as the total station.

These early EDMs were powered by twelve volt batteries. I often used the battery in my car or hauled around a heavy twelve volt battery to power the EDMs. To save weight I later used a motorcycle, 12 volt battery. If my memory serves me correctly, the batteries never seemed to last an entire day. They seemed to always be drained at the farthest point from the road.

I will end discussing the early EDMs with the statement that the horizontal distance always had to be calculated using the zenith or vertical angle. If the EDM was mounted on the standards of the angle measuring equipment, the offset had to be taken into account. Long distances often required numerous prisms stacked upon each other in order to get sufficient light reflected back to the EDM to effectuate a measurement.

GPS – I suppose someone seeing this heading will exclaim that the GPS is not an old piece of equipment relegated to history. If you had seen the GPS equipment I first used, you would admit it was historical and that equipment is relegated to history.

The historical GPS equipment was large and cumbersome. Several twelve-volt car batteries were often required to operate the equipment and obtain sufficient satellite data. The GPS receiver could not be used at any time of the day or for that matter any day of the week. There were not sufficient satellite constellations to allow for 24-7 operation of the GPS. Depending on the satellite constellation configuration for that day, data could only be collected during a limited time window. I often occupied a station in the darkest hours of the night in order to comply with a pre-determined window of opportunity for receiving satellite data. I met more than one police officer that was very suspicious of my activities.

Spending hours on a station to obtain sufficient data was common. In fact, multiple observation windows (think days) of observation were often required. In the earliest GPS, the timing of when the GPS was to be turned on was

(continued on next page)

Reminisce of An Old Surveyor *(continued)*

important. When I speak of timing, I mean down to the odd minute.

Now I ask, does this GPS I have just explained remind you of what a person now uses as they run around with that light weight GPS receiver on a prism pole, collecting numerous locations in a day?

Other Equipment: My colleague, Carlton Brown, has written several articles about slide rules and early calculation machines so I shall not mention those. I will say that when I first started surveying there were no calculators. I used logarithm tables and had to look up trig functions in a book. Unless you have tried to look up log and trig values in a book of tables, you have no idea of the errors that often resulted from trying to interpolate values using the tables in the book

I have no doubt there were other items of equipment used by historical surveyors that I have not mentioned for the simple reason that I have never used the equipment or forgotten I used the equipment when writing this reminisce. Forgetting is easier and more common as I get older. I am sure surveyors of my age can add their thoughts and should do so before we pass into history.

MSPS Online Education Portal

Many Missouri surveyors have now gone to the MSPS online education portal (accessible through the MSPS website) to take continuing education courses for surveyors' professional development. While the majority of enrollments have been for the former Minimum Standards Courses, there have also been enrollments for other general surveying material on topics varying from ALTA surveys to state plane coordinates to RTK surveying to geodesy and more.

We are pleased to report that with the help of Missouri State Surveyor Ron Heimbaugh and his staff, we are creating new courses reflecting the new Missouri Standards for Property Boundary Surveys as well as other content taught by other staff within the Missouri Land Survey.

By the time this article prints, some, if not all of the new courses will be available for your enjoyment. Check them out!

Get to the portal at the MSPS website: www.missourisurveyor.org
Click on the Online Learning Portal badge; read about the portal and click again to go to the portal to register, review the catalog, and take your courses

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Mail or fax completed form to the Mail Society of Professional Surveyors, PO Box 1342, Jefferson City, MO 65102 or Fax: 573-635-7823, no later than August 15, 2018. If you have questions contact Joe Clayton, Awards Committee Chair.

Awards

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

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

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

Past Recipients Include

Surveyor of the Year Award - Joe Clayton, Richard Elgin, Stan Emerick, Robert Ubben, Darrell Pratte, Chris Wickern, Mark Nolte, Ralph Riggs, John Teale, Shane Terhune, Mike Gray, Don Martin, Dan Lashley, Richard Cox, Jim Mathis, Jim Anderson, Robert S. Shotts, Troy Hayes, Craig Ruble, Gerald Harms, John A. Holleck, John Stevens, Richard Barr, Erwin Gard, Charles Kutz, Robert Myers, Dan Govero, Jim Anderson, Mike Flowers, Bob Pirrie, and Jerry Day.

Robert E. Myers Service Award - Darrell Pratte, Robert Ubben, Gary Bockman, Sharon Herman, Troy Hayes, Rich Howard, Stan Emerick, Don Martin, Robert Myers, Charlie Kutz, John Teale, Jim Mathis, Robert S. Shotts, Stan French, Gaylon Smitth, Dan Lashley, Gerard Harms, John A. Holleck, J. Michael Flowers, Erwin Gard, Rich Norvell, David Krehbiel, Richard Elgin, Dan Govero, Jim Anderson, Rich Barr, Norman Brown, and Harold Schulte.

Odds & Ends

Workday

Monnie Sears reports the SW Chapter is planning a workday on June 21st to add OPUS observations to the 2022 Datum that will replace NAVD-88 and NAD83. The more observations that are submitted, the more accurate the Geoid will be for southwest Missouri.

The plan is for participants to meet the morning of for instructions about the new Datum and the mechanics of doing OPUS observations. Then everyone will go to their designated monuments, set up their GPS units and take a session. When the sessions are completed all will gather again for lunch followed by downloading OPUS info and submitting it to NGS.

The SW Chapter will be joined by State of Missouri NGS Coordinator Jeff Moss and his boss Ron Heimbaugh, the State Land Surveyor. Local firm Allgeier, MArtin and Associates is making their conference room available for gathering, prep and processing.

Surveyor Star Shines at Cannes

Movie director Gianni Zanasi's entry into this year's Cannes Film Festival is Troppa Grazia. It is the story of a woman's encounter with her "…own personal Madonna who is coming to her to say, 'Do something with your life,'" Zanasi says. "The Madonna pushes her to get out of her comfort zone and to start taking control of her own life."

The woman is a *land surveyor* who is planning the site of a grand, new building project. She soon finds multiple mistakes in the maps given to her by city officials and a building site full of geological risks. But she is afraid to speak up for fear of losing her job. Through her timely encounter with the Madonna she finds the strength to overcome her job fears and life challenges. Alba Rohrwacher plays Lucia the Land Surveyor.

Good Reads

A couple of very fine pieces written by Illinois surveyor Tim Burch are worth your reading time. Check these out…

Surveying and the GNSS generation: The future is now. Because of technology, data collection and advancements of the profession, today's surveyors are faced with many more challenges than their predecessors. Here's how surveying has changed over the years, as well as what the future holds for the professional surveyor.
Read at...
http://gpsworld.com/surveying-and-the-gnss-generation-the-future-is-now/

GPS, surveyors and politics — a 2018 refresher. Many of the hours spent to protect the profession are in the political arena, where the battle for budget dollars and service rights are fought on nearly a daily basis. Because of the reliance of the surveyor on technological advances, the profession has been thrust into the political arena at all legislative levels.
Read at...
http://gpsworld.com/gps-surveyors-and-politics-a-2018-refresher/

Be a Magazine Cover Model or News Maker!

Highlight your work! Impress your friends! Make your momma proud! Prove to the bankers you are using that commercial loan!

"How" you may ask? By sharing photos, stories and news with Missouri Surveyor! It is really that simple. Just as this edition's cover features Missouri surveyors you and your work may be featured as well. All content is welcome! For the cover, high quality images in landscape format at an aspect-ration comparable to 17"x11" work best; stories and articles merely need to be in Microsoft Word.

2018 Corporate Members

Firm	Member Name	Street Address	City/State/Zip
Phoenix Engineering & Surveying, LLC	Wesley Scrogham	3855 S. Northern Blvd	Independence, MO 64052
Riggs & Associates, Inc.	Ralph Riggs	102 W. Trish Knight St., PO Box 71	West Plains, MO 65775
Shafer, Kline & Warren, Inc.	Larry Graham	1700 Swift Ave., Ste. 100	N. Kansas City, MO 64116-3821
Buescher Frankenberg Associates, Inc.		103 Elm St.	Washington, MO 63090
Anderson Engineering, Inc.	Kevin Lambeth	2045 W. Woodland	Springfield, MO 65807
George Butler Associates, Inc.		9801 Renner Blvd.	Lenexa, KS 66219-9745
Migar Enterprises, Inc.	J. Bernard Baldus	PO Box 528	Grandview, MO 64030
Bax Engineering Co., Inc.	Dale Bax	221 Point West Blvd.	St. Charles, MO 63301
Cole & Associates, Inc.	Terry Westerman	1520 S. Fifth Street, Ste. 307	St. Charles, MO 63303
Bartlett & West, Inc.		1719 Southridge Drive, Ste. 100	Jefferson City, MO 65109
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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	Ron Shy	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 Brickey	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 Road, 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
Midland Surveying, Inc.	Adam Teale	501 N. Market	Maryville, MO 64468
Cochran	Steven Laune	530 A E. Independence Dr.	Union, MO 63084
Aylett Surveying & Engineering		201 NW 72nd Street	Gladstone, MO 64118
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Whitehead Consultants Inc.	Michael Taylor	114 N. Main St.	Clinton, MO 64735
Schlagel & Associates, PA	David Rinne	14920 W. 107th St.	Lenexa, KS 66215
Frontenac Engineering Group, Inc.	William Berthold	2725 Sutton Blvd. B	St. Louis, MO 63143
Bader Land Surveying, Inc.	Gerald Bader	16255 Sugar Bottom Road	Ste. Genevieve, MO 63670-8613
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
Cochran	Timothy Van Leer	737 Rudder Road	Fenton, MO 63026
Minnick Surveying, LLC		3520 Hampton Avenue	St. Louis, MO 63139
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
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 CWM, Inc.		3200 S. State Route 291, Bldg. 1	Independence, MO 64057
Brungardt Honomichl & Co., P.A.		7101 College Blvd., Ste. 400	Overland Park, KS 66210
Cook, Flatt & Strobel Engineers	Michael Adams	2930 SW Woodside Drive	Topeka, KS 66614
Westwood Professional Services	Brian Kruse	7501 College Blvd., Ste. 101	Overland Park, KS 66210

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