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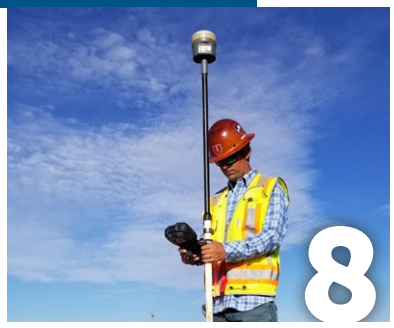

Clint Griffin, Party Chief for Topographic Land Surveyors, working on a pipeline infrastructure project in Eddy County, New Mexico.

features

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editorial

State Boards

Why do we have state boards of registration for surveyors? The answer is pretty simple. Damages from our mistakes can easily exceed our client's assets, not to mention our own. I'm not talking about the price of a bad haircut, either. I'm talking about catastrophic loss of property, assets, and resources. Simple examples include errors with residential property lines or construction stakes. Complex issues arise when we consider duties like the placement of high rise buildings. Setting aside the millions of dollars at stake from errors, vertical and highway construction present extreme occupational risks of personal injury and death. Vertical and commercial construction is a costly endeavor and the risk takers require competence from their partners. State licensing boards provide the measure of competence for high stakes development.

As our federal and state governments drape their public concerns over our private land development process we see a greater need for state boards to monitor minimum competence among land surveyors. The foundation of licensure is to maintain an unbiased cadre that represents facts objectively to the public. The agencies thrusting these social interests on our private endeavors are liable to the same standards as everyone else. The agency, the public, and the private developer are all protected fiscally, ethically, and morally by engaging the neutral registrant vetted through the state board. This impartial surveyor is responsible for objectively laying down the extents of rights between those competing private and public interests. The interloping agency can assert their standards to the professional and expect compliance with the private developer's project deliverables.

Further protection is afforded to the public through an unbiased peer review process. I'll tell you first hand that a truly unbiased peer review makes neither a grumpy public nor a disenfranchised registrant happy. What it should accomplish is a determination of compliance with the standards adopted by your state. The reason the public may not be happy is the same reason they hire you in the first place. They simply are not familiar with the pertinent laws, standards, and accepted practices.

Lately there seems to be a sentiment that the state land surveying boards are some unnecessary and burdensome form of regulation restricting free markets. Quite frankly that's a misrepresentation. The restrictive regulations that burden my clients are generated by the local planning agencies and state statutes influenced by land development lobbyists, Realtors, and construction interests. At the federal level we see FEMA, EPA, USACOE, and BLM impacting the timeliness and budgets of my client's projects. These agencies assure public compliance by relying on the individual state's licensure process as the standard of minimum competence. Any land owner, be they "mom n' pop" or the most sophisticated international developer must circumnavigate through an ocean of regulation. The surveyor has emerged as the public's chaperon through the red tape that strangles private land development. Ironically the regulation imposed on obtaining a land survey licensing is minimal. The initial fees associated with applications and testing are dimes to dollars when compared to paying the taxes and fees collected when purchasing a new vehicle. Annual renewals are less than a monthly cable TV bill. I don't experience any unnecessary cost restriction in maintaining my various licenses. Nor, have I experienced any protectionism with regard to obtaining licenses in multiple states. Good or bad, the only restriction to licensure that comes to mind is in states that have elected to bar applicants not possessing a bachelor's degree. Otherwise, our experience requirements seem commensurate with a reasonable professional gestation period. So, long story short, the board is the public watchdog carrying the professional yardstick. ■

Jason Foose is a Professional Surveyor licensed in multiple jurisdictions.

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JASON E. FOOSE, PS

decided guidance: case examinations

Ward v. Marshall

The case of Ward v. Marshall was decided in West Virginia just about 30 years ago and rests just outside of Beckley, West Virginia. John Denver was absolutely right about West Virginia. Anybody that has visited the hollers around Beckley can't unhear that song. Okay, enough said and on with the case.

Let's start by breaking down the rather lengthy syllabus Item 2 with some color commentary. "*Where a deed calls for a line between monuments…*" Okay this is sounding like a monument thing, "*…as well as by course and distance…*" Oh, wait we've got calls, "*…one of which monuments is standing well marked and unquestioned…*" Okay, I think I know where this is going, "*…while the other has long since disappeared and its location is not definitely ascertained…*" Yeah, I'm following, "*…and surveyors differ in their locations of the latter…*" Naturally. "*…with the result that recent surveys, purporting to represent such line, materially vary…*" Sure, why would I expect anything less? "*….each being supported by measurements to and from other known monuments…*" Well yeah, you'll have that every now n' again. "*…thereby enveloping its true location in doubt and uncertainty…*" I think we're almost there. "*…the solution of the conflict so presented is peculiarly within the province of a jury…*" Okay, things are getting legal now. "*…and its finding, in the absence of a clear preponderance of evidence to the contrary and of prejudicial error during the course of the trial…*" Come on, stick a fork in this thing already. "*… cannot properly be disturbed by the trial court upon motion or upon writ of error from this court.*" Are you kidding me? That's it? We went through every survey detail known to mankind just to ask if a lawyer did his job? Really?

> "…its true location in doubt and uncertainty the solution of the conflict so presented is peculiarly within the province of a jury…"

Okay, here's the stuff they didn't teach us in civics class. The higher courts seem to shun the idea of overturning a trial court's decision. Now in all fairness and in contrast to the long-windedness, syllabus Item 1 is very direct and gets right to that point. It reads "*In a case where the evidence is such that the jury could have properly found for either party upon the factual issues, a motion for judgment notwithstanding the verdict should not be granted.*" I'm thinking this was a real humdinger of a case if the court is saying it could have gone either way. In the Supreme Court's words "*Based on our review of the record, we find that an analysis of the deeds could not resolve the ownership of the disputed property and thus, there was a genuine issue of material fact that was properly submitted to and resolved by the jury.*" Okay, so the deeds are collectively broken. The rest of Item 1 seems to be some sort of lawyer ramblings that don't fit into any in my vest pockets. So let's make like Tiny Tim and tiptoe through the tulips over toward the legal descriptions.

The Marshalls' deed contained the following description:

> *Beginning at the southwest corner of W. M. Taylor's lot running straight across the bottom to the branch, and thence running in a north direction with the branch to a willow, leaving the branch and still running north to a stone; thence in an eastern direction to a stone, a corner to William Taylor's lot near the road at the foot of Rock Creek Mountain; thence running with the William Taylor's line to the beginning corner.*

Not too shabby. I mean it closes, right? It's not a bad set of instructions. It reminds me of how owners actually describe their property when I ask them "where's your property lines?" The Ward's deed contained the following description:

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BREAK NEW GROUND

Beginning at two sourwoods on side of Rock Creek, corner to Lot 1, thence 81-1/2 E. 68 poles to a large hickory, S. 47-1/2 W. 11 poles to two hickories, S. 29 W. 7-3/4 poles to two hickories, S. 11-2/5 E. 6-3/4 poles to a stone white oak pointer S. 18-1/4 E. 30-3/4 poles to a stake, chestnut, oak and gum pointers, corner to Lot 3; thence with the same S. 23-1/2 W. 36-1/2 poles to a white oak, S. 48 W. 12 to Rock Creek Road; thence with said road S. 64 E. 17-4/5 poles, N. 55-1/2 E. 6-1/2 poles to _____ N. 36 E. 9-1/4 poles, S. 17-1/2 E. 25-3/4 poles, S. 12 W. 16 poles, S. 38 W. 12-4/5, S. 54-¾ W. 12 poles, S. 21-1/4 W. 14-3/4 poles, S. 7-1/2 W. 14-3/4 poles, S. 15-1/2 poles, S. 5 W. 3 poles to a chestnut, corner to Lot 1, thence with same N. 41° 12 poles W. 16 poles to a chestnut, N. 12-1/2 W. 50 poles to a stone in a branch; N. 33° 36' W. 25 poles to a stone, N. 13° W. 12-3/5 poles to a branch, N. 22° W. 12-1/5 poles to a stake, N. 17-1/2 W. 7-1/5 poles to a white oak stump N. 29-¼---- 12-1/2 poles to a maple and dogwood, N. 22-3/4 E. 9-2/5 poles to a small poplar N. 2 27-½ E. 28-3/4 poles to a hickory on top of Rock Creek Mountain, N. 55° 36' W. 17-2/5 poles to a small black oak, N. 21-1/2° E. 9 poles to the beginning, and containing 49 acres and 125 poles.

It looks like Ward's description was written by a surveyor. Now let's run the tally. For starters we're not in Old T-Jeff's checkerboard. So us PLSSers need to take our square thinking caps off. Okay, be forewarned that Marshall's description doesn't have a child proof lid or a safety seal. In fact, there's not a single number or any math called out in this one. You kids might want to grab your juice boxes and pick up your bike helmets before Chupacabra shows up. Now, on to the good stuff. Ward has himself what I like to call a tree description and it's as good as a big old bowl of warm gravy. How many times have we heard about those in the urban legends of Johnny Pipestaker the perennial bluetopper? Plenty. Now how many of us actually have had to implement this type of evidence? My guess is only the experts but what do I really know? <Wink, wink, nudge, nudge> So, the monuments are living and growing objects. If they are no longer alive we may have to "Nyhus" our way around on the ground and scratch up some roots. It might help to know a little bit of dendrology, now wouldn't it? We also have a great call to a physical monument. I'm not sure what exactly is meant by "Rock Creek Road" but I sure as hell know that I ain't gonna call it off by a few tenths. Well, that and there'll be some intense research and correspondence with the Raleigh County road authorities. Then we have some stones which you all know might be covered by leaves or a century of decomposing organic matter that just needs scraped away from the surface. And finally we have our units of measure. Poles are normally 16.5 feet but that's not always a given. The bigger issue here are the angular units and calls. What is 81-1/2° 68 poles? Well, first of all who cares as long as you make it to the large hickory called out in the deed. Secondly, I bet there's declination that should be applied to that direction. Thirdly, interpolating to half of the smallest written unit or 1/4°, we see it subtends about a half pole (8 feet) at 68 poles (1,122 feet). I suppose you could apply some statistical logic and say +/- 8 feet, or 16 feet, or about a pole but the point is I could park a small RV over it and still be on the mark. Yeah, and I'm looking for any large hickory that stops that RV dead in its tracks. If there's more than one large hickory, well I guess I'm dropping jacks and roasting a weenie. Who doesn't like camping in an old hickory grove?

> "So the real test of ambiguity is if one surveyor starting from two different places would arrive at two different answers?"

Okay, so we've talked about how to use these descriptions. The court said they don't work together and I believe it. What intrigues me about this case is the following statement "...(surveys) *each being supported by measurements to and from other known monuments thereby enveloping its true location in doubt and uncertainty, the solution of the conflict so presented is peculiarly within the province of a jury…*". I take that as the court saying these folks definitely need a jury to iron things out. The other notion I take up is that the court recognized two surveyors starting from two different points arrived at two different answers. So the real test of ambiguity is if one surveyor starting from two different places would arrive at two different answers. Not possible you say? I bet the other 99% of the readers would disagree with you. I'll go double or nuthin' that they just did, and I'm all in on you just mumbling "Glad I'm not in that one percent". Hey, what can I say? My readers are good surveyors. Alrighty then, here's a hypothetical. We just ran the ambiguity test by ourselves and the legals failed. Are we obligated to pick one over the other? Better yet, should we pick one over the other? I'll raise the ante and ask do we even have the authority to pick one over the other?

What draws me like a skeeter to a bug light is that nothing works together here. That's why this case belonged in court. All the king's horses and all the king's men couldn't put this dumpty together. I question whether surveys should have been finalized under such ambiguity. Yes there's a public expectation that we can get the job done but you can't make biscuits n' gravy without flour.

On the other hand these are competing claims of title and the judicial expectation is that we lay out the evidence. It goes without saying that the local surveyors truly are the experts and know how to work in their neck of the woods. So they are best poised to lay those questions down.

Our next professional challenge goes far beyond the antiquated craft of mechanical measurement. We are evolving into a role of mediator and witness. Truly it only takes one surveyor to identify ambiguity if we are doing our job with diligence and without bias. I've seen too many grenade throwers and self-righteous water walkers thrust their narcissistic opinions on an unassuming public. Regardless of those opinions we are surveying someone else's property. On the road to resolution what seems personally "right or wrong" to the rope stretcher may have been left behind at the last rest area.■

Jason Foose is the County Surveyor of Mohave County Arizona. He originally hails from the Connecticut Western Reserve Township 3, range XIV West of Ellicott's Line Surveyed in 1785 but now resides in Township 21 North, Range 17 West of the Gila & Salt River Base Line and Meridian.

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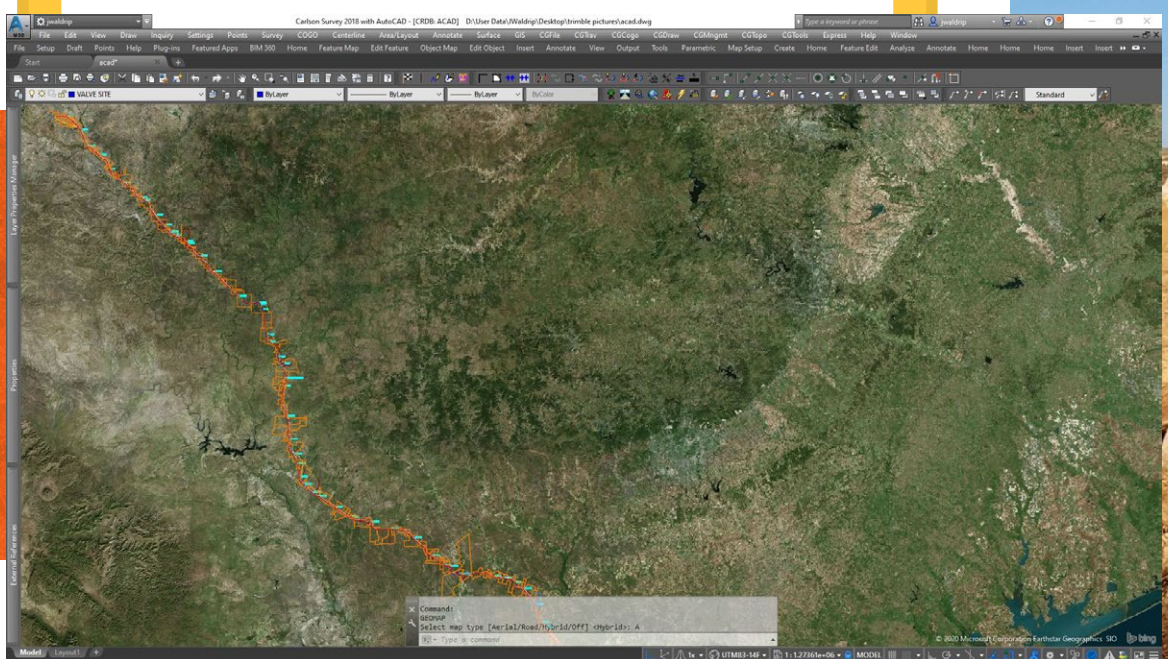


» NICK KLENSKE

Texas is oil country.

But before the rigs start pumping and the black gold flowing, pipes need to be laid and drilling locations must be staked. And that is where Topographic Land Surveyors, Inc. comes in. As a full-service specialist in land surveying, GIS/mapping and civil engineering, Texas-based Topographic Land Surveyors serves both the traditional and emerging energy sectors.

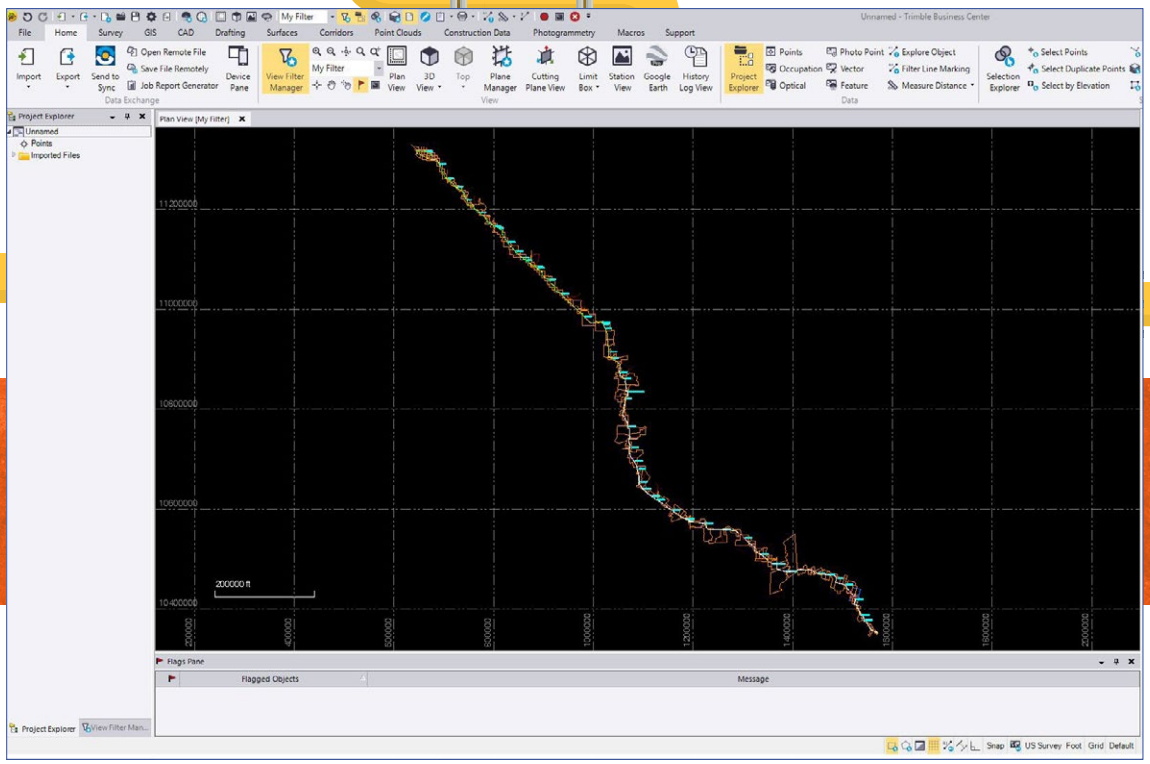
"Our bread and butter is the oil and gas industry," says Josh Waldrip, Manager of As-Built Services at Topographic. "From Texas to New Mexico, Colorado, Oklahoma, Wyoming and North Dakota, we provide our clients with the location and positioning for installing underground pipelines and for staking drill sites."

The Right Solution for Rural, Remote and Rough Terrain

Before GNSS surveying came along, Topographic's crews needed to start every job from a known or assumed control point. "This meant doing things the 'old school' way—carrying a total station or even using tape measures and chains," says Waldrip.

Today, 95 percent of Topographic's work is done using GNSS. The company has 15 crews equipped with Trimble® R10 GNSS Receivers and Trimble CenterPoint® RTX correction service. Topographic regularly uses CenterPoint RTX for major projects such as staking wells and pipeline routes, along with smaller as-built projects. The company is currently using CenterPoint RTX to survey a 185-mile pipeline that runs from Oklahoma to Texas.

Typically working in remote areas with limited cellular coverage, the Topographic crew use Trimble CenterPoint RTX with a Trimble R10 GNSS Receiver.



Topographic Surveyors use the Trimble Business Center software to deliver the accurate footage of pipe, acreage of land and location of features that their customers demand.

Trimble CenterPoint RTX correction service uses GNSS data from a global network of GNSS reference stations. The data is streamed to Trimble control centers where it is processed by advanced modeling algorithms to generate correction data for real-time precise GNSS positioning. The corrections are broadcast to roving GNSS receivers via communications satellites or over the Internet via cellular phone services. The rover uses the information to produce high-accuracy GNSS positions. Users can achieve horizontal accuracy of 2cm in real time, equivalent to RTK but without the need for reference stations and radio datalinks.

This use of satellites to deliver the GNSS corrections makes the system particularly well-suited for Topographic's work in remote locations. "Getting to job sites is often a challenge for us," explains Waldrip, "They tend to be in hilly, rocky and generally rough areas. The beauty of

With Trimble CenterPoint RTX, users achieve horizontal accuracy of 2cm in real time.

Topographic Land Surveyors provide its clients with the location and positioning for installing underground pipelines and for staking drill sites.

RTX is that it provides real-time location anywhere, meaning our crews don't have to traverse through forests or other rough and sometimes dangerous terrain just to set up RTK base stations or operate total stations."

In addition to dealing with rugged landscapes, crews regularly need to route pipelines around private property, archeological sites, protected habitats, utilities and waterways. Waldrip says that CenterPoint RTX removes the headache of setting up, maintaining and moving base stations.

"Because we don't have to set up a base station, use a radio or worry about cell service with RTX, we can hit the ground running," he explains. "All we need to do is get in the truck, go to the job site, calibrate and start collecting data—it's that simple, which is exactly why our crews love it."

Waldrip notes that satellite delivery comes with a cost-saving benefit. "RTX replaces both the radio and the GNSS base station, meaning we save the cost of regularly buying—and repairing—these units," he adds.

Providing the Needed Accuracy

After using CenterPoint RTX on a number of smaller projects, Topographic is putting the service to work on a pipeline surveying project that will run from Cushing, Oklahoma south to Trenton, Texas. The 185-mile pipeline is part of a planned 840-mile line that will eventually extend to the Gulf of Mexico.

Because cellular and network coverage in this remote area is spotty, VRS and RTK won't be options. Instead, Topographic's crews are again using CenterPoint RTX with a Trimble R10. "Like most of our projects, this job requires that we survey everything with centimeter-level accuracy," says Waldrip. "We can only do this using Trimble RTX correction service."

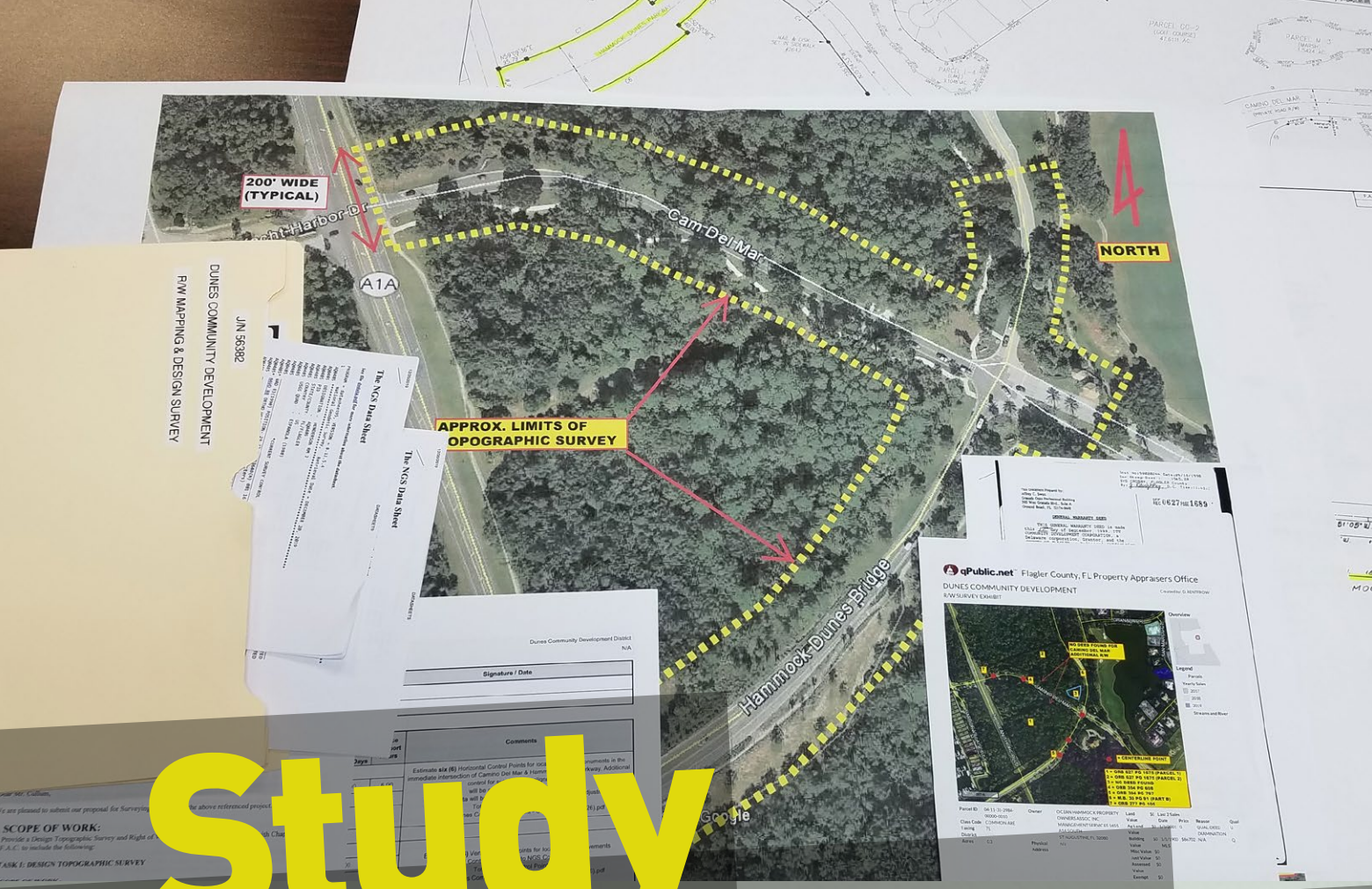
Because CenterPoint RTX performance is equivalent to VRS or RTK, the level of precision will provide Topographic's client with the accurate footage of pipe, acreage of land and location of features above or below ground.

To achieve this accuracy, and per the client's specific request, Topographic crews use static GNSS techniques to set control points. The static data is processed in OPUS and then calibrated to the specified coordinate system. The points then serve as the basis for the control and calibration of the RTX real-time work.

"Using RTX allows us to work faster and more accurately, both of which give us an important competitive edge," says Waldrip. ■

Nick Klenske writes about science, technology and innovation. Based in Chicago, he can be reached at *nickklenske@gmail.com*.

Trimble CenterPoint RTX removes the headache of setting up, maintaining and moving base stations.



Study the SCOPE

Survey projects are routinely plagued by scope violations. One cause of this problem is that technicians assigned to the project are not familiar with the scope. If the staff has only a sketchy knowledge of the scope, the project is susceptible to cost overruns and schedule delays. Unfortunately, the tedious nature of a scope is only captivating to the person(s) who wrote it. In fact, many clients are more concerned with cost and schedule, than they are with the details of the scope. However, technicians must comply with the scope, and they need more than encouragement—they must study the scope. Money is at stake!

A project needs more than just busy hands to flourish—it also needs active minds. All projects benefit from well-informed participants. Employees who delve into the scope and become intimate with a project can conduct the operation more efficiently and express concern over its outcome.

If the technicians ***study*** the scope, they can create an effective plan to streamline the various processes or help develop initiatives. This type of creative process is used throughout the business world. For example, in the movie industry, it's essential that the cast and crew study a script prior to filming to develop their own characters, costumes or techniques. Imagine

» DAVE RENTFROW, CST IV

an actor showing up the day of a film shoot, and informing the director, "I haven't read the script. Just tell me what to say, where to stand, and how to act." The director is likely to replace that actor.

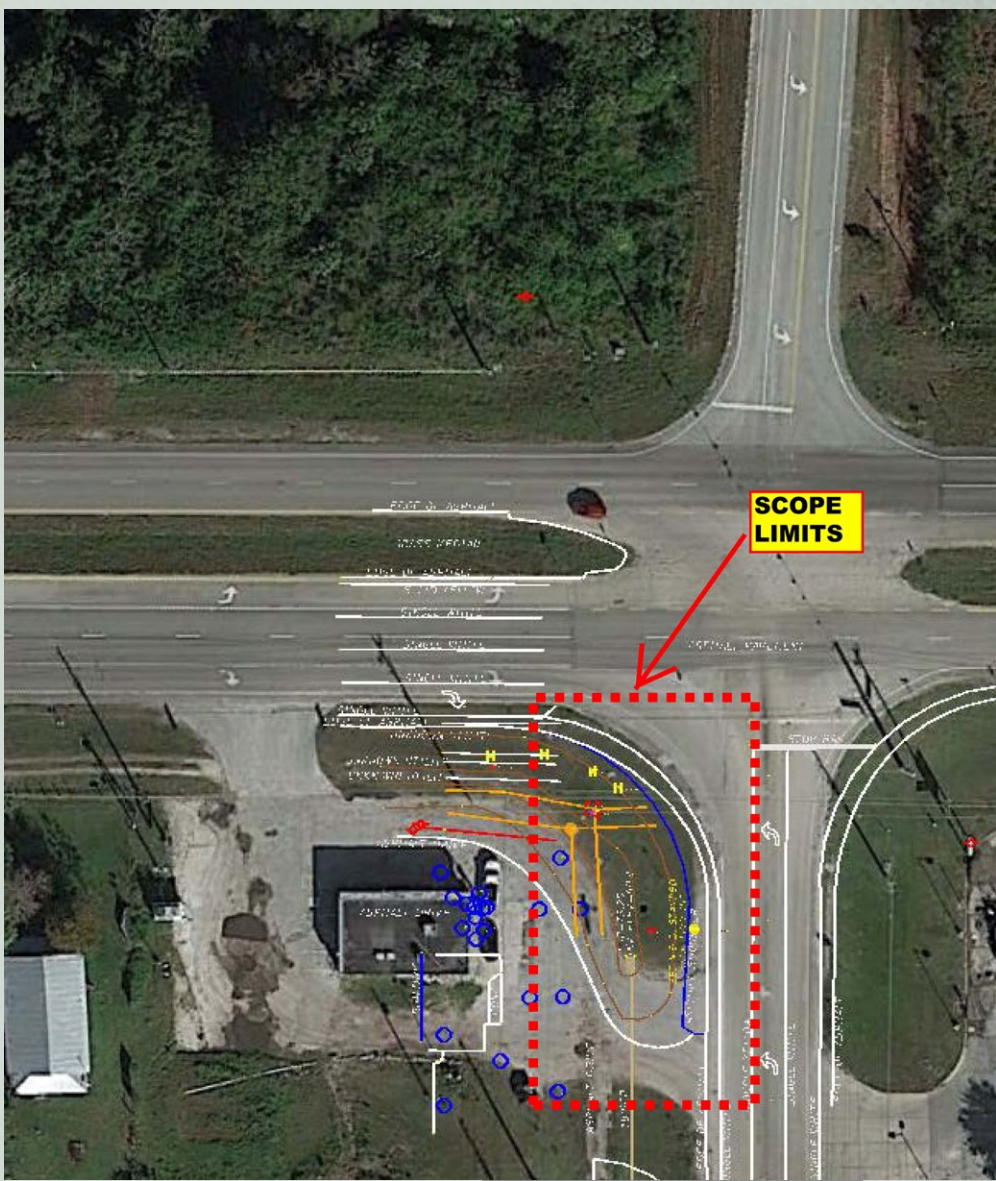
Unfortunately, in the survey industry, it's rare when the field crew or technicians are familiar with a project from the onset. When workers have little or no knowledge of a project, they require a thorough explanation of the job and may need to be guided every step of the way. Conversely, workers who are familiar with a project will take an immediate interest and require far less guidance. Hence, the initial stage of the operation becomes more streamlined, and creative interest will be immediately generated.

In both surveying and the movie industry everybody hopes the final product is a big hit.

Kick-off Meeting

In the surveying industry, the Field Crew and CAD techs are usually introduced to the project during a "Kick-off Meeting" usually conducted by the Project Manager. The purpose of this meeting to convey the project scope and objectives. Unfortunately, this vital meeting may not generate much excitement, and the results can be quite disappointing.

Although the term "Kick-off" is derived from football, it is inappropriate when applied to surveying. Prior to the kick-off of a football game, coaches and players alike have thoroughly prepared for their opponents, developing an integral game plan, and planned for most any eventualities. In the surveying industry, the Party Chief usually learns of the project details



Above: Example of Field Team going well beyond the scope limits in every direction. producing data that was eventually processed, drafted and verified.

Project Manager Kirk Hall conducts a Kick-off Meeting with Field Team Leader Chris Hollenbeck

on the same morning the field work begins, without the benefit of any preparation or planning. This lack of readiness can impact both productivity and effectiveness.

To help alleviate this problem, the Party Chief should study the scope, ***prior*** to the Kick-off Meeting. This background knowledge will enable the Kick-off Meeting to go much smoother and avoid the need for clarifications.

The details of a scope can be very complex and difficult to grasp. For instance, FDOT projects may involve up to 30 different field tasks, and an equal number of mapping activities. Construction projects can be equally intricate, with the staking of various proposed improvements and development stages involved. During the Kick-off Meeting, the ultimate objectives should be summarized with emphasis placed on the immediate task at hand, such as recovery and establishment of control.

The beginning of any project should generate a certain degree of excitement, but a complicated survey project could easily baffle or even discourage the workers. With no advance preparation, the "shock" value of the project may adversely affect the team from a psychological standpoint—even to the point of being overwhelmed by the magnitude of the project. If the project is complex, the team may lose focus on the scope, hoping their colleagues have grasped the assorted concepts. Consequently, the eagerness of exploration may be stymied by uncertainty, and the moment of discovery is lost in the fog of details.

The complexity of the scope is directly proportional to the tedious nature of the Kick-off meeting. If the Project Manager simply recites the scope, the staff may lose interest and even become drowsy. The Kick-off Meeting then morphs into a bedtime story. Occasionally, the staff will lose focus on key instructions, and become distracted. Some participants may quietly devise their own approach. Others simply lose interest in the meeting, altogether. This "deer in the headlights" reaction has been witnessed by all Project Managers, causing a certain feeling of dread. A Kick-off Meeting might conclude with the following exchange:

"Do you have any questions?" the Project Manager asks the Chief.

"We'll figure it out," replies the Chief with a shrug.

(*Translation: "I have lots of questions, and the project is doomed."*)

Free of Charge

Projects are frequently afflicted by "scope creep", which is the process of exceeding well-defined scope limits or tasks, resulting in cost overruns and schedule delays. In some cases, the client needs more data, and hopes the surveyor will provide it free of charge.

Unfortunately, a large amount of scope creep is caused by the staff assigned to the project. This sometimes happens because they are simply not familiar with the scope. If the staff "skims" over the scope, without attempting to gain an intimate knowledge of the project requirements, the result is often a haphazard approach to execution.

Since the main goals of any project are to achieve scope objectives, within schedule and budget parameters, then well-defined scope boundaries are crucial to meeting those goals. However, these boundaries are sometimes blurred by both client and surveyor alike. Unfortunately, when a field team exceeds scope limits, both budget and schedule are adversely affected (see illustration). When the scope is violated, the Party Chief may defend this action by saying, "I knew the client would want this." The Chief may possess certain powers of E.S.P., but still needs clear authorization prior to any scope deviations. The one absolute is the client wants the survey ASAP.

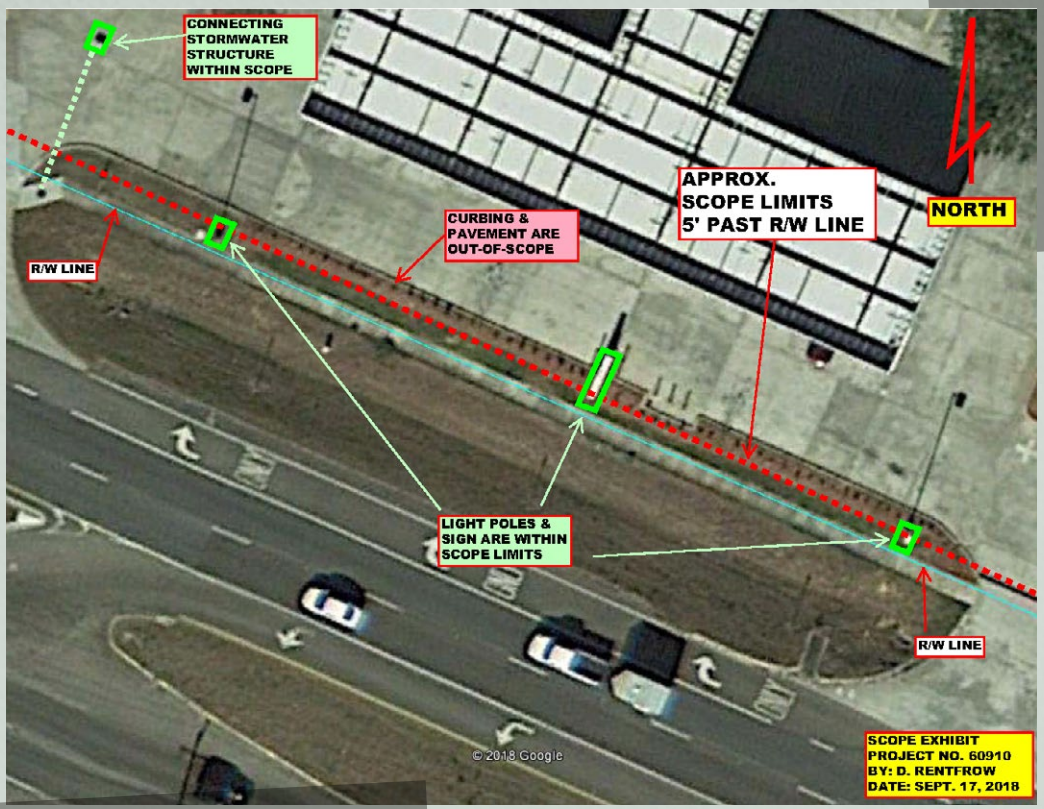
The Party Chief may further defend this action by claiming "it didn't take that long." However, this estimate does not include the time necessary for processing, drafting, Quality Control, etc. And if the survey is flawed, corrective measures are also costly.

> "When a Party Chief deliberately exceeds the scope, the Project Manager should ask, "Who is going to pay for all that?"

Construction projects frequently suffer from scope creep. Superintendents are notorious for using a field team for whatever suits their purpose. It may be to set an additional benchmark or replace a stake. The Chief wants to stay in good favor with the client, so the out-of-scope work is provided without obtaining the necessary authorization.

When a Party Chief deliberately exceeds the scope, the Project Manager should ask, "Who is going to pay for all that?" The Chief may be disappointed that no praise was given for the extra effort. The Project Manager should identify the costs of salaries, materials, fuel, insurance, etc., and then ask the Chief to provide their own estimate for additional work, so they can appreciate budget constraints.

Conversely, when confronted about the field data falling short of the scope limits, the Chief will ask, "Do you realize how long it would take to get all that?" Counter by asking, "How long do ***you*** think it will take?" These tests will help the Chief understand the various aspects of the estimating process.



Example of defining scope limits. Use color codes as an aid. Green is good. Red is beyond limits.

> "If Chiefs are expected to know the scope, they cannot be rushed through preparation."

Creativity

Creativity is necessary in both formulating and executing a plan. Encourage participation in the creative process to improve efficiency and tackle difficult problems. Listen to every suggestion. Some suggestions may already be a part of the plan, and some may not be useful at all. However, if only one idea out of twenty is used, it may be a gem, so every idea must be considered. If all ideas are summarily rejected, then team members will become discouraged and reluctant to offer any suggestions, wanting to avoid certain humiliation. This may even cause the team to remain silent when they are certain a mistake being made.

In this context, creativity is not necessarily devising an innovative approach, but more of an ability to envision the processes necessary to achieve desired goals. If the Team has some advance knowledge of a project, they can ponder over the major events, and conceive their own ideas for executing the various tasks. For example, if a team knows the survey falls within dense woods, they can make certain their machetes are sharp. If the Field Team has only sketchy details, they will have to scramble to prepare and may forget something essential to the process.

The field team should be encouraged to explore the scope, as well as the other contents of the field folder, including plats, R/W Maps, deeds, standards, etc. (see illustration) Some surveyors find this type of research a tedious exercise, but exploration is the stock-in-trade of surveying, so research is a necessary function and must be done with gusto.

The Hard Part

The cost of preparation will vary depending on complexities and scheduling parameters. If Chiefs are expected to know the scope, they cannot be rushed through preparation. The 1st question of the Kick-off Meeting should be "have you studied the scope?" If the answer is "no", then allow them time for that purpose. This may amount to a costly delay but will be time well spent if they re-emerge with a grasp the concepts and have formulated a plan. Give the Chief the opportunity to explain his or her approach to executing the plan. It may not be the exact the path you had in mind, but it will demonstrate the Chief has carefully considered matter and has developed a viable plan. And if a problem arises, at least the Chief will be better prepared to devise a solution, instead of struggling.

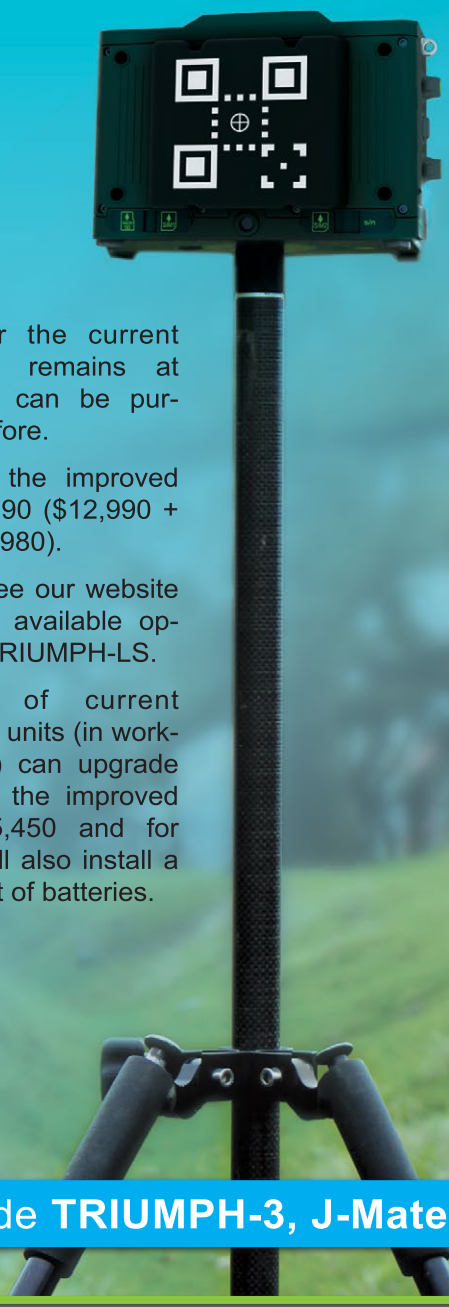
There will also be an adjustment for management. Crews are expected to hit the road by 7:15, but it may be necessary to start a half an hour earlier. Also, encourage the team to discuss the project on their way to the job site. Unfortunately, there are many cases of Field Teams driving to the job, only to return to the office because they forgot something essential to the job. When that occurs, it's unsettling to think that the crew never discussed the job but knowing there was plenty of talk about sports, or fishing or pretty girls. Hopefully, the team will learn a valuable lesson from that episode and focus on their duties—along with the pretty girls.

Employees will react differently to this approach. Some will take it lightly and maintain the status quo. Other workers may initially adopt the philosophy, but their enthusiasm will fade in time. Others will take it to heart and will display an inquisitive nature in all aspects of the job—something we pray for in the surveying profession. Of course, a go-getter may be teased by their co-workers and branded as a "company man". However, in the eyes of Management, that person may be characterized as an excellent worker. In any event, that person is the star of the show.■

Dave Rentfrow is a Level IV Certified Field Manager and Level IV Certified Survey Office Manager, and has been a Project Manager since 2006.

Upgrade to TRIUMPH-LS Plus

Option available for the TRIUMPH-LS with the following features, using the new ASIC:



- **Improved signal tracking and signal processing (wideband tracking) and adding Galileo and BeiDou L6 bands and Galileo AltBoc and BeiDou AltBoc signals.**
- **Improved multipath reduction due to wide band tracking.**
- **Improved spectrum analysis to show and reject spoofers and jammers option.**
- **Improved RTK with four "Super Engines". Each engine uses all signals of all satellites but with different parameters for different conditions.**
- **Improved internal Wi-Fi antenna that works both as directional and omnidirectional. No need for external Wi-Fi antenna.**
- **Improved internal Bluetooth antenna and longer range.**
- **Lower power consumption and extended battery life.**
- **J-Mate ready: Integrated J-Target painted on the back of TRIUMPH-LS.**

Price for the current TRIUMPH-LS remains at $12,990 and can be purchased as before.

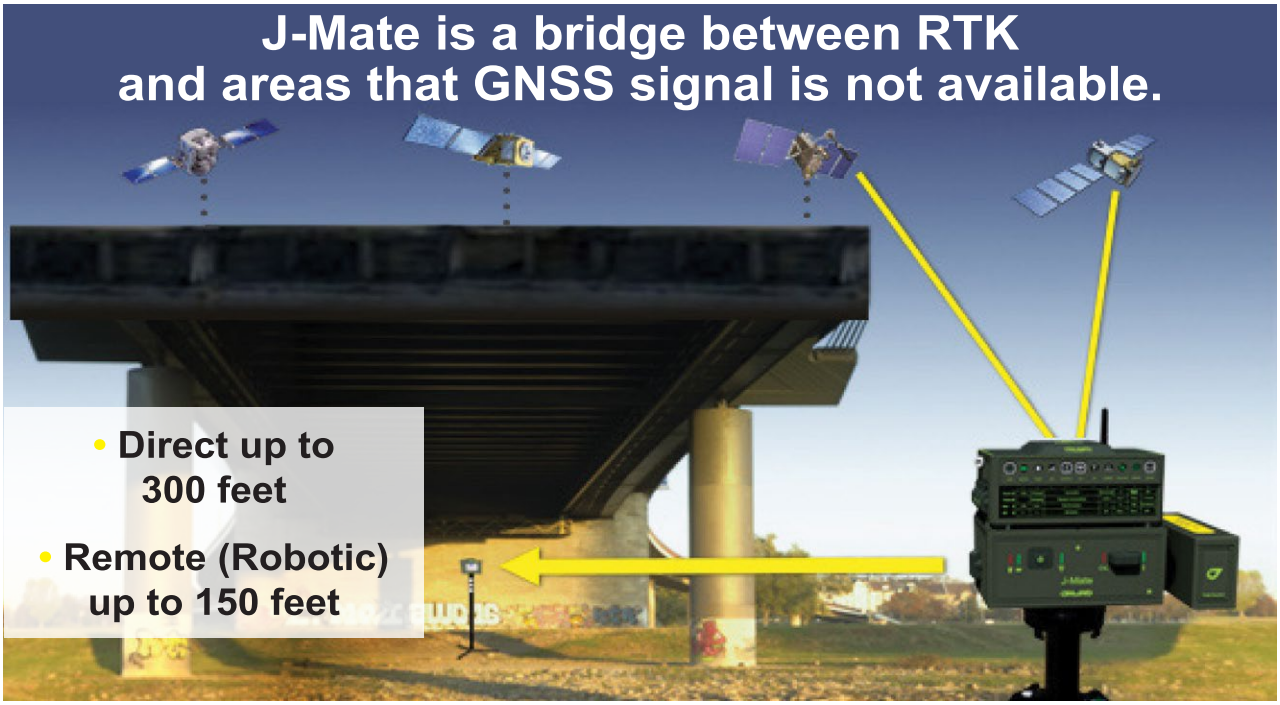
Price of the improved option is $4,990 ($12,990 + $4,990 = $17,980).

Please see our website for additional available options for the TRIUMPH-LS.

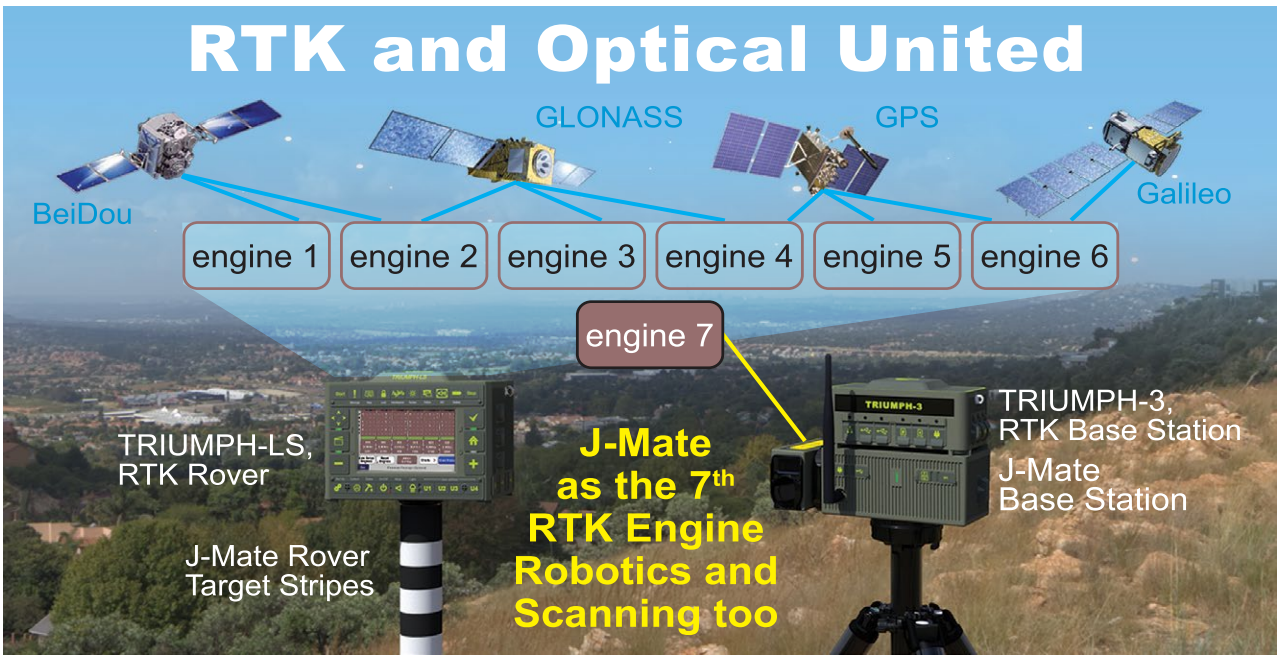
Owners of current TRIUMPH-LS units (in working condition) can upgrade their units to the improved option at $5,450 and for $5,700 we will also install a brand new set of batteries.

See inside **TRIUMPH-3, J-Mate, GNSS Signals** and more **>>**

J-Mate



J-Mate is not a total-station. J-Mate and TRIUMPH-LS together make the "Total Solution" which is a combination of GNSS, RTK, camera, angle encoders and laser range measurements that together do, conveniently and cost-effectively, a lot more than a total station. For long distances, you use GNSS and for short distances (maximum of 300 feet in Direct mode and 100 feet in Remote/Robotic mode), you use the J-Mate along with the TRIUMPH-LS. Together they provide RTK level accuracy (few centimeters) in ranges from zero to infinity.



TRIUMPH-3

The new TRIUMPH-3 receiver inherits the best features of our famous TRIUMPH-1M.

Based on our new third generation TRIUMPH chip enclosed in a rugged magnesium alloy housing.

The TRIUMPH-3 receiver can operate as a portable base station for Real-time Kinematic (RTK) applications or as a receiver for post-processing, and as a scientific station collecting information for individual studies, such as ionosphere monitoring and the like.

It includes options for all of the software and hardware features required to perform a wide variety of tasks.

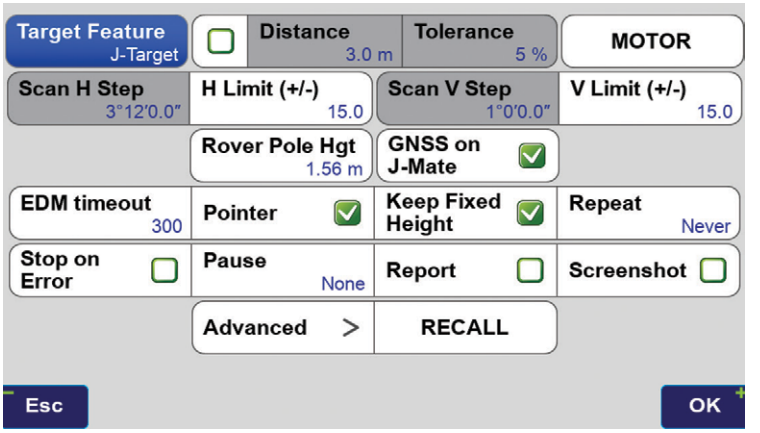
- UHF or Spread Spectrum Radio
- 4G/LTE module
- Wi-Fi 5 GHz and 2.4 GHz (802.11 a, b, g, n, d, e, i)
- Dual-mode Bluetooth and Bluetooth LE
- Full-duplex 10BASE-T/100Base-TX Ethernet port
- High Speed USB 2.0 Host (480 Mbps)
- High Speed USB 2.0 Device (480 Mbps)
- High Capacity microSD Card (microSDHC) up to 128GB Class 10;
- “Lift & Tilt”
- J-Mobile interface

Ideal as a base station

Searching and finding objects by laser and by Optics

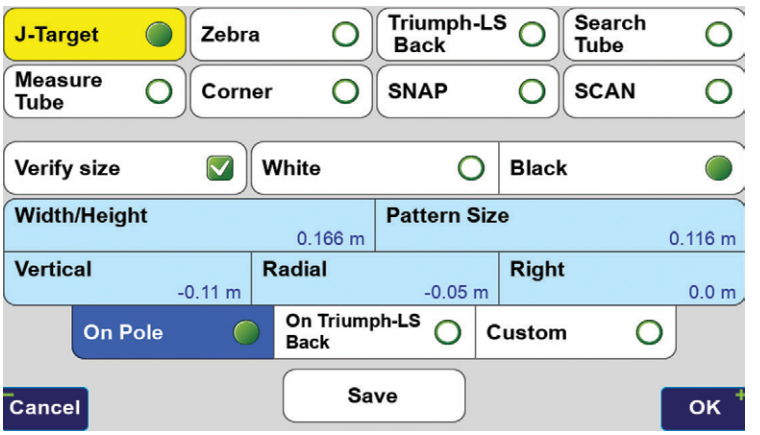
J-Mate has the unique feature of searching for objects by laser and by optics (camera).

Click button  and select “Target Feature” to see the setup screen for target selection and parameters. If you know the approximate distance to the target, click the check box and enter the distance and accuracy percentage. This will help J-Mate to ignore targets that are outside the range.



Horizontal and Vertical Limits are the limits that J-Mate will search around the starting point to find targets.

“Keep Fixed Height” check box, scans horizontally on fixed target height. You may rarely need to use this feature. It will reduce the scanning speed by a factor of 2.



“Laser time limit”

The time that it takes for a laser measurement depends on the reflective surface of the target and weather conditions (dust and moisture in the air).

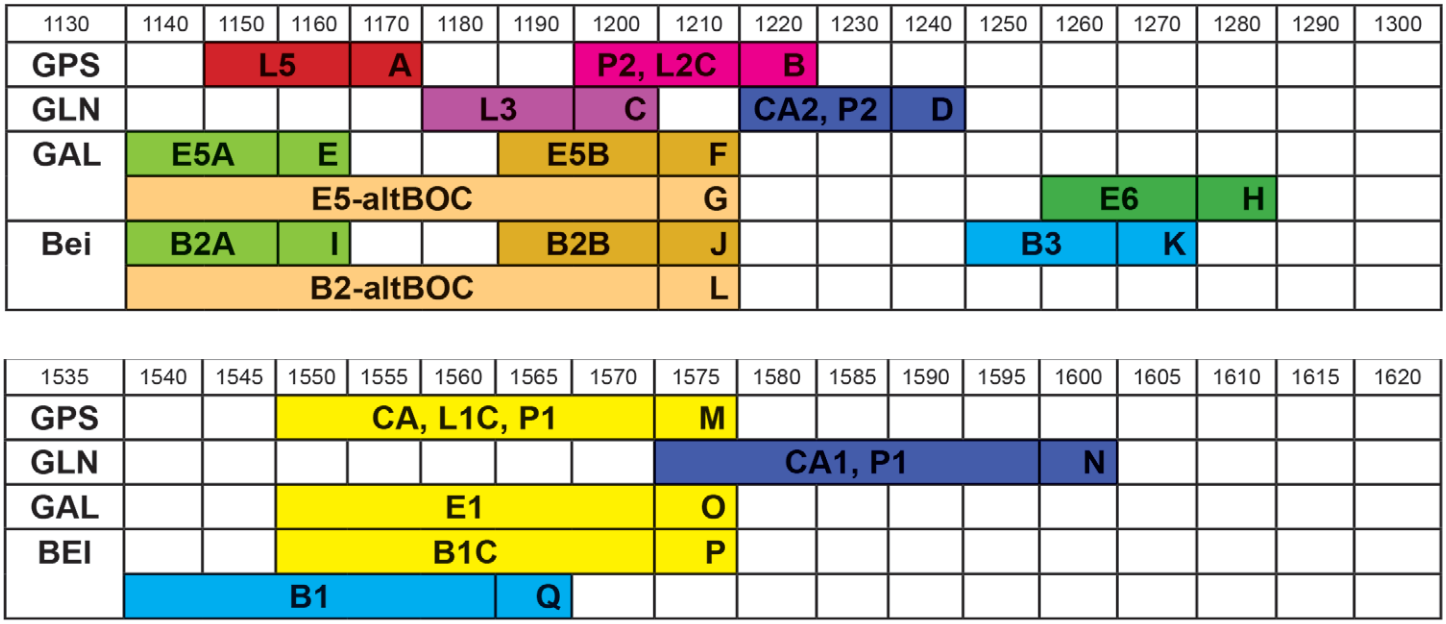
On a good white reflective surface and in clean air, it takes about 50 milliseconds to have a laser reading. If there is no reflective surface, or the reflective surface is black, it may take up to 4 seconds to have a laser reading.

If the surface of the object that you want to scan is a good reflective surface, limit the laser time to a fraction of a second. This will cause the laser to skip points that do not reflect enough energy in the time limit that you specified. This will significantly increase the scan speed and will ignore points that are not possibly your target and reduces the chance of identifying a wrong object.

Target Features and its offset from the top of the pole are shown in the “Target Features” screen. You can change the parameters by selecting the “Custom” button.

TRIUMPH-LS Back: You can use this feature to search for the back of TRIUMPH-LS and measure to its center to make sure laser range measurement is not from an unintended object.

GNSS Signals in the improved TRIUMPH-LS with the new chip



GNSS bands for GPS, GLONASS, Galileo and BeiDou signals are depicted in the above figure.

There are total of 22 signals in 17 frequency bands labeled “a” to “q”. Note that GPS C/A, L1C and P1 are in the same band (m) and GLONASS CA/L2 and P2 also are in the same band (d) of the same satellite. In selecting signals for RTK processing, as an option, we may choose to select only one of such signals in the same band. We label this option as “No Same Frequency” option in signal selection strategy screen, discussed later.

GPS				GLN				GAL				BEI			
C/A M	1.0	8	8.0	C/L1 N	1.0	8	8.0	E1 O	1.0	6	6.0	B1C P	1.1	8	8.8
P1 M	0.8	8	6.4	P1 N	1.2	8	9.6	E5B F	1.2	8	9.6	B1 Q	1.0	9	9.0
L2C B	1.0	8	8.0	C/L D	1.0	8	8.0	E5A E	1.2	7	8.4	B2B J	1.2	9	10.8
P2 B	0.8	7	5.6	P2 D	1.2	7	8.4	Eboc G	1.5	6	9.0	B2A H	1.2	8	9.6
L5 A	1.1	5	5.5	L3 C	1.2	2	2.4	E6 H	1.1	8	8.8	Bboc L	1.5	8	12.0
L1C M	1.1	8	8.8									B3 K	1.1	10	11.0

We categorize the GNSS signals as shown in the above figure. The first column is the name of the signal and its designated signal letter (e.g. GPS C/A m). Signals with the same color are those that we discussed earlier as being in the same frequency band of the same system.

The second column is the quality indicator of that signal. Because GPS P1 code, for example, is encrypted and in recovery we lose about 10db of its signal strength we give this signal the quality indicator of 0.8. GLONASS signals also get lower score because of their FDMA signal structure which results in inter-channel biases, even though we reduce such inter-channel biases in our signal processing techniques. Galileo AltBoc and BeiDou AltBoc signals get quality score of 1.5 because of their wide band and signal quality.

The third column is the number of available signals for RTK.

The multiplication of the second and third column is shown in column four, which is an indication of the value of that signal for RTK.

The four super engines

This screenshot shows the four super engine screens. Each engine shows the signals that are used for that engine.

The numbers below each engine are:

- First line is the GDOP of the selected satellites for each engine.
- Second line is the number of signals used / number of signals rejected.
- Third line is epochs since the last reset.
- Fourth line is the solution difference from the first engine.
- Fifth line is the total run time.
- Clicking on each engine, restarts the RTK fix process.
- Long click on each engine to select signals for that engine manually as shown in the figure below.

This screen shows all signals tracked by the TRIUMPH-LS which is real-time indication.

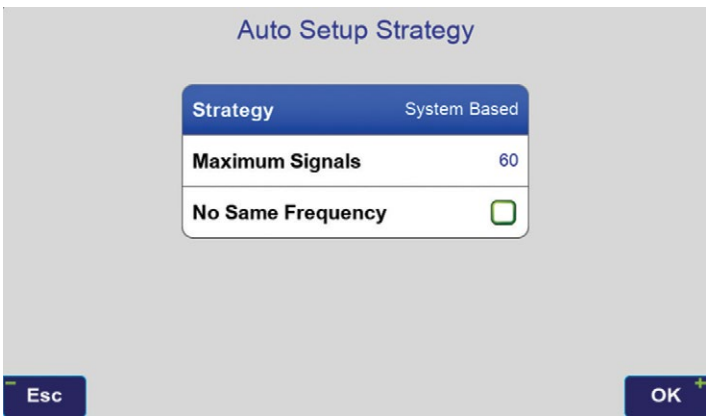
For each system, the name of the signal and its designated signal letter and quality indicator (e.g. GPS C/A M 1.0) are shown. GPS and GLONASS Signals with the same color sideband are those that we discussed earlier as being in the same frequency band of the same system.

Next to the signal name, the top number in each cell is the number of signals tracked by the Rover and the number below that is the number of signals tracked by Base. The smaller number of the two represent the number of common signals between base and rover.

You can long click on the signal name to change the quality indicator of that signal.

Each system is sorted by the number of common signals multiplied by the signal quality indicator.

The number below the signal name is the percentage of noise in that band. Numbers above 30% hint possible spoofing in that band. In case of jamming the original signal and adding a spoofed signal, this percentage may raise to even 200%.



"Auto Setup Engine" button selects signals for each engine automatically according to the strategy option selected by user.

For selection strategy, hold the "Auto Setup Engine" which leads you to the following screen.

"Maximum Signal" box allows you to limit the number of signals used for each engine. Numbers above 60 limits RTK solutions to one per second. Numbers below 30 allows 5 Hz RTK.

The "No Same Frequency" check box selects only one of the GPS and GLONASS signals in the same band as explained earlier.

Click "Strategy" button to select the strategy for automatic signal selections for each engine.

You can long click on each engine and select signals for that engine manually.

In "System based" strategy, for the first engine all GPS signals are used (subject to the check box and Maximum Signal parameters) and then complemented with the best other signals up to the "Maximum Signal" limit. The other three engines are similarly selected by giving preference to GLONASS, Galileo and BeiDou, respectively

In "All the Best" strategy, the best signals among all systems are selected and identical signals are given to the four engines (subject to the Maximum Signal number and the No Same Frequency Check box).

No signal type will be selected unless at least four satellites transmit that signal.

Each engine can accept maximum of 8 signal type. And each signal type can have maximum of 10 signals.

Clicking the "Reset Engines" button, resets all engines.

You can switch between "Convention Tracking" and Independent Tracking by clicking on this button. Conventional tracking users information from the L1 band to help other bands.

The number of the bottom right of the Figure 3 is the number of lost data from the base since the last reset. Long click to reset it to zero.

New feature

There are three types or RTK engines:

1) 6 engine GPS + GLONASS;

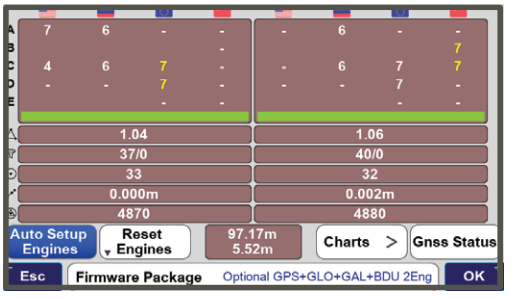
2) 6-engine multi constellation, and

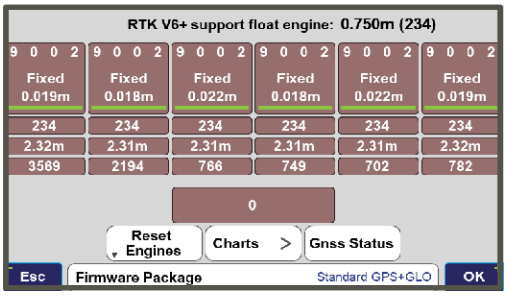
3) 2-engine multi constellation.

The engine selection button is on the bottom of the "engine view" screens. Changing the engine type takes about one minute for the TRIUMPH-LS to reboot.

"Auto Setup Engines" button selects signals for each engine automatically. You can click and hold on each engine to assign signals manually. The number assigned to each signal is the "Figure of Merit" of that signal according to the number and strength. "0" is perfect. "10" is very bad.

"GDOP" of used satellites are shown below each engine. "GNSS Status" button shows the Figure of Merit number for each signal. Click on any signal number to get details. The lower the number, the better the signal.





Who Moved My Base?

Real story by Shawn Billings

I was surveying in a rural neighborhood with lots of trees near a Corps of Engineers lake. There were not many base locations nearby, so I had to find a place about a mile by road (or 3500' straight-line) from my site to set up the base. The choices were few, but I found a place that was clear near the side of a public road about 600-700 feet from a house. I set up and started my job. All was going well and I had about 30 minutes - an hour left before I would be finished with the job. It was promising to be a productive day! Then my LS reported that my base had moved!!! I ran for my truck and quickly navigated the windy roads back to where I set it up. Adrenaline was pumping as I considered that my base was likely stolen. I showed up, semi-relieved, to see a woman standing by her car, arms folded near where my base once stood. I immediately figured this was the property owner where I put my base and she wasn't happy with my trespass. She gave me a good verbal lashing. I simply wanted my base back so I sheepishly agreed that I was in the wrong for putting my threatening equipment on her property a five feet or so from the top bank of the road ditch. About thirty feet away, they had some old culvert pipes stockpiled. There, the owner had stuffed my still-running Triumph-2 on the tribrach and tripod into one of the culverts. The HPT435BT, also still running, was plugged into my large deep-cycle battery which was placed behind the culverts. I still don't know how she didn't damage any of it by moving it from the setup and shoving it into the 12" pipe. She took my picture as I loaded up my truck and I waived affably offering to give her a business card so she'd know who I was. She replied with a few more expletives and I was on my way. I ended up completing the job with my total station (the first time I've used it in many months). But I was extremely thankful for the base guard feature that immediately warned me of trouble at my base and even more thankful that I was able to recover it and that it is still in good working order.

To take advantage of the base guard feature, make sure that your Javad base receiver is calibrated. You can do this by connecting to the base in base/rover setup and then going to the calibrate screens in J-Field. Calibrations made while the base is connected will calibrate the base instead of the LS. Once done, be sure the base guard feature is checked on.

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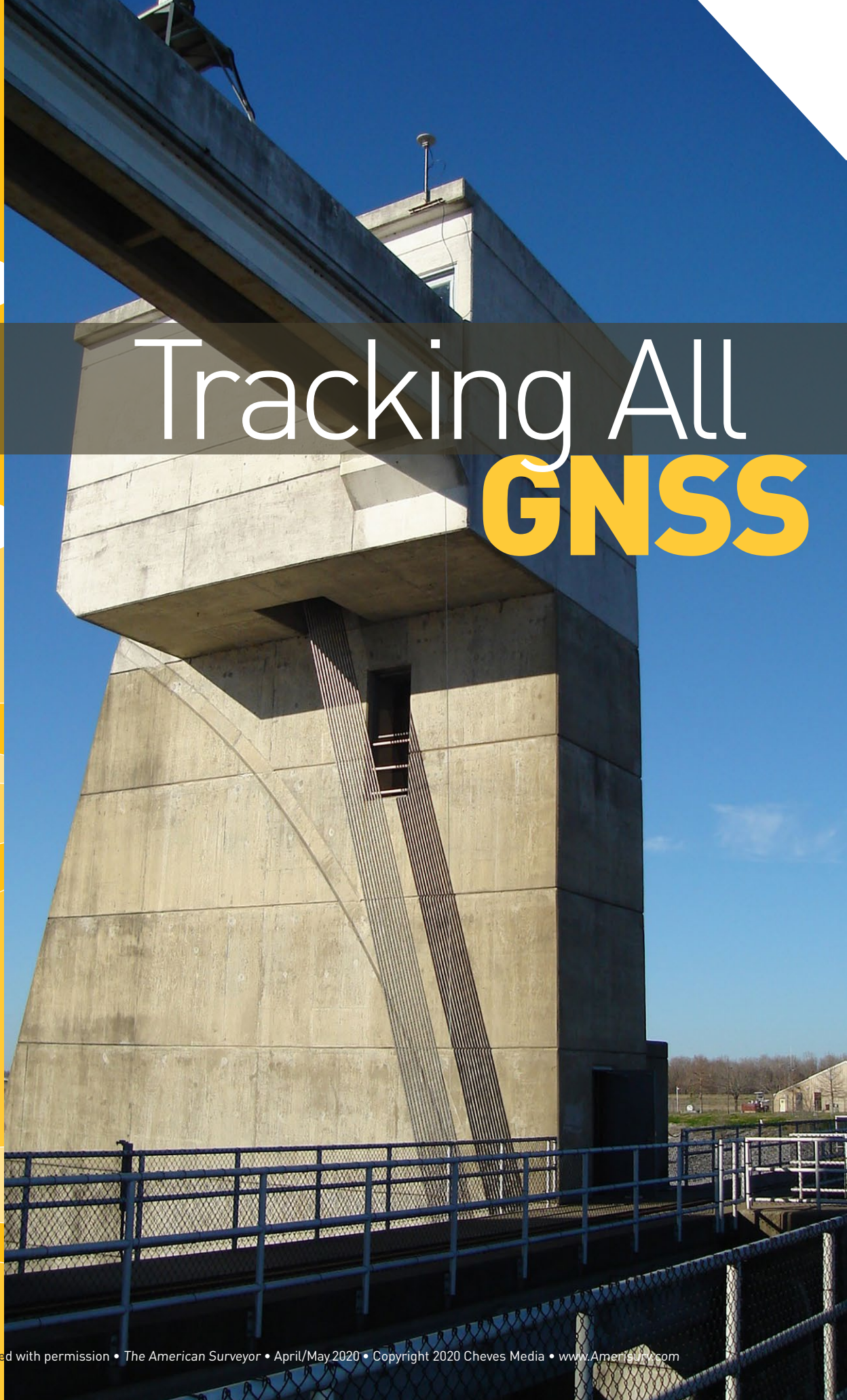
Tracking All GNSS



An LSU C4G GNSS base station located at the U.S. Army Corps of Engineers Old River Auxiliary Control Structure in Simmsport, La.

Constellations

Why it matters to surveyors

We interviewed three Global Navigation Satellite System (GNSS) real-time network (RTN) operation experts about the advantages of talking to all available constellations. While some people may think it is only necessary to access their regional GNSS constellation, there are several advantages afforded by talking with satellites from other regional constellations.

Our industry experts include:

- **Sean Fernandez**, state cadastral surveyor and RTN administrator for the State of Utah Automated Geographic Reference Center
- **Kimberley A. Holtz, PLS, PG,** Director of Survey for Port of Long Beach
- **Randy L. Osborne,** network manager at the Louisiana State University Center for GeoInformatics

SEAN FERNANDEZ

Q: When you began your career in surveying/GNSS network management, how many constellations were available to you

Sean: I started surveying in 1989 for the Utah Department of Transportation using a 100-foot steel tape and a Wild T16 Theodolite to lay out roads. I worked with a five-person survey crew that consisted of two chainmen holding the steel tape, a rod man, an instrument man, and a crew chief that took field notes and ran the calculator. A simple job at that time would take days and sometimes weeks for a large crew to complete.

Such a project was reduced to just a few hours in 1994 when I began using GPS total stations and a local/mobile base station that used a 900 MHz UHF radio to broadcast the real-time corrections from the base to the rover. The solution was limited to line of sight and the maximum distance was about 1.5 miles. With this new set up, a two-person crew is all that was needed to complete the same type of project that previously required five people.

During this time in the mid-90s, there was only one satellite constellation available to surveyors, which was the U.S. Department of Defense Global Positioning System (GPS); it had only 24 satellites. To conduct a real-time GPS survey, five satellites were required to obtain the necessary data for a GPS fix with validation, and throughout a normal day, there were several periods where less than five satellites were available, often making it difficult to achieve accurate results without careful planning.

Located in Shell Beach, La., a NOAA storm hardened tide gauge sentinel (circled in red) contains one of LSU C4G's GNSS base stations, accessible only by boat!

Q: What was the next constellation to become available to you? How did that impact your work and the services you provide?

Sean: During the early years of my survey career, the only constellation being utilized for satellite positioning in Utah was GPS. In 2007, several GPS manufacturers incorporated the Russian constellation, GLONASS, that was still under construction, but had some satellites available to add as a secondary system to GPS. Even though GLONASS wasn't fully developed at the time, it did offer several more satellites to the solution, which significantly improved the windows of time surveyors could work. It also improved the ability to work in canyon areas, next to buildings and even improved working in tree canopy.

Surveyors who were GPS skeptics transitioned from using traditional survey methods for 100% of their work to investing in GPS total stations and making it their primary source for collecting positional data. Tech-savvy surveyors switched over right away but were frustrated with only being able to work certain hours during the day. It wasn't a good option for all jobs.

Looking at the bigger picture, it's great when new constellations or new satellites are announced. It makes the solution more mainstream when people hear about this technology and how it is used. This leads to people looking to use high-accuracy GPS for other applications like flying drones and autonomous vehicles.

Q: What advantages does your network gain by using signals from multiple constellations?

Sean: In Utah, we have a real-time GNSS network of just over 100 stations, and 50% of those receive GPS and GLONASS. Some of our GNSS reference receivers have newer constellations that are not yet fully activated; we're in the process of adding Galileo and BeiDou.

Our users buy survey and mapping equipment and need to maximize all the features to get the best results. New receivers are capable of seeing all constellations' satellites,

Sean Fernandez and Martin Janousek, Trimble Advanced Positioning Sr. Product Manager, catching up at the Trimble Dimensions user conference.

The installation site of a GNSS base station for The Utah Reference Network (TURN).

but if the network can't do the same, the users' rovers can't see all the satellites. Modernizing our network allows people who have invested in equipment capable of utilizing all constellations to take complete advantage of their investment. It also improves the ability to survey in locations that we couldn't before and for more extended time. Surveying in canyons, next to buildings and tree canopy were limited to certain times of the day. Now, we can pretty much do our work all day and all night.

As a network operator, having more constellations come online, we see global navigation getting more visibility, and from that, more demand for it. Users are getting educated on the services of the system and hearing about satellites from other countries. Other people are wondering why we need all these constellations. Our goal at The Utah Reference Network (TURN) is to provide high accuracy. And we can do that with more people subscribing to our network because that leads to more funding. Also, with more constellations and more satellites improving accuracies, the number of base stations needed to achieve the accuracies our users require to get the job done quickly and accurately will be reduced.

Q: Have you had the opportunity to use data from the BeiDou constellation?
Sean: We have receivers that are BeiDou-III capable, but we can't yet see it processed. Currently, we are tracking all the BeiDou satellites from 26 stations in the network.

When BeiDou first came online, many surveyors were skeptical because geostationary satellites could not be utilized in the U.S. We didn't initially pay much attention, thinking it would not become a part of our solution. With the recent launch of BeiDou-III, we can now see that we're going to be able to take advantage of another full constellation of satellites. We plan to support efforts that will make BeiDou a part of our solution.

Q: How many more constellations do you think there will be in the future? Is the sky the limit?
Sean: I do believe there will be more constellations to come online. There is a place for satellites that are broadcasting more powerful signals and a place for satellites flying at different altitudes that may improve future applications. We've seen this with existing constellations, like GPS, with a version of a satellite that was launched initially, but now replaced with another constellation they didn't anticipate. Countries with their own constellations will upgrade as new technology emerges, and countries without constellations will want to contribute as technology advances. Yes, the sky's the limit.

KIMBERLEY A. HOLTZ

Q: When you began your career in surveying/GNSS network management, how many constellations were available to you?
Kimberley: There weren't any constellations available when I started my surveying career in 1985. Around 1990, I started using GPS with the County of Orange. I remember having to survey at night to get four satellites in sight. Conducting static surveying at the time, we had to carry two car batteries to ensure we could get our work done that night! It was very rare to get four satellites over the U.S. because the military was using GPS primarily for Desert Storm. By the late '90s, we could get GPS any time of the day but had to pre-plan to be out at the right time to obtain satellites. It became much more manageable when GPS Block II came on board in 1989. With the additional satellites, we could measure horizontal points at any time of the day. But, because we measure subsidence at the Port of Long Beach, we still had to wait until we had enough satellites for a low dilution of precision (DOP) for our vertical measurements.

Q: What was the next constellation to become available to you? How did that impact your work and the services you provide?
Kimberley: First, it was GPS Block II and then Galileo. These constellations made it possible to see seven or eight satellites at a time. The signal quality and solution greatly improved, including no longer having to pre-plan for horizontal measurements. Surveyors used Trimble's GNSS planning software in conjunction with the latest almanac. This especially helped with our subsidence measurements.

The biggest difference is that we don't have to do any pre-planning and we can survey for more than a couple of hours a day. In the late '90s and early 2000s, you couldn't just turn on your equipment and expect a good answer. Today, it is easy to turn different constellations on and off with our Trimble equipment to get the best position.

Kimberley A. Holtz stands next to a GNSS base station that withstands the harsh marine environment year-over-year at the Port of Long Beach, Calif.

Located at Amerada Pass, La., this NOAA storm hardened tide gauge contains one of LSU C4G's GNSS base stations.

Q: What advantages does your network gain by using signals from multiple constellations?

Kimberley: Now, we can see nine to 10 satellites using GPS Blocks I and II, Galileo and GLONASS. This provides better data, which lowers your DOP (dilution of precision). Some days, you may want to cut out a satellite to procure quality data, and we also use our Trimble Pivot software to automatically eliminate bad data. Having access to more constellations matters to different degrees depending on where you are in the world.

Q: Have you had the opportunity to use data from the BeiDou constellation?

Kimberley: We are doing a horizontal control network that represents a 15-year rail project in the port. This control will be used for the design survey and throughout construction. We will consider utilizing the BeiDou system for some of the measurements. However, we will test it first, to see if it helps improve our data, makes it worse or if it is even noticeable.

Inside an LSU C4G GNSS base station enclosure that has access to Ethernet and AC power.

Q: How many more constellations do you think there will be in the future? Is the sky the limit?

Kimberley: I don't think there will be too many more. The current ones will get upgraded or densified by adding more satellites. Some countries might establish their own networks, but it's more likely everyone will stay with the ones already up there.

RANDY L. OSBORNE

Q: When you began your career in surveying/GNSS network management, how many constellations were available to you?

Randy: When I began working at the LSU Center for GeoInformatics (C4G) in late 2007, only GPS was available for our users in Louisiana.

Q: What was the next constellation to become available to you? How did that impact your work and the services you provide?

Randy: GLONASS came next. We entertained using it because our clients wanted more satellites to be available so they could make GPS observations without a lot of mission planning. Additionally, having more satellites in the sky made it possible to work more during the day.

This posed a problem for us because our mature network receivers only had GPS capabilities. We had to replace all of our GPS infrastructure, purchasing newer receivers that could talk with GPS and GLONASS. At the time, our funding came from government earmarks, so we implemented the upgrade in small portions over time. We've progressed through Trimble's NetRS to NetR5, then NetR8 and NetR9. Now, we're adding in some new Trimble Alloy GNSS reference receivers, but we are only licensing the GPS, GLONASS and Galileo constellations. In Louisiana, we don't need QZSS because it doesn't geosync around to our part of the world, and, for similar reasons, we are not using BeiDou or NavIC.

Q: What advantages does your network gain by using signals from multiple constellations?

Randy: Having more signals solves one of the original problems users had in the field, which was the ability to see enough satellites for horizontal and vertical positioning. More satellites on your radar is always better than having less.

Access to GPS, GLONASS and Galileo primarily benefits the rovers in our network. When using a network solution, having access to these constellations in urban canyons or tree canopy—where you can't get a clear view of the sky, or the geometry is clumped together—you can better solve vertical problems. This is essential in Louisiana and is really the only way to get a good position. That position in real-time is critical for those working on jobs that are in a constantly changing environment. On the science side and for the research we are doing at LSU, we don't face the same challenges.

Q: Have you had the opportunity to use data from the BeiDou constellation?

Randy: Our Trimble NetR9s have BeiDou turned on, but we can't see all of this constellation's satellites. So far, our clients haven't asked to use it.

Different constellations do different things, but those satellites that are specifically on the other side of the earth don't help much right now. At some point, those constellations might add more satellites that could help. But, today, they are not important to us.

Q: How many more constellations do you think there will be in the future? Is the sky the limit?

Randy: Potentially, every country could have its own constellation, but I don't see the need for it. I think it is most likely that existing constellations will send up more satellites. Or, maybe people will start to set up their own personal networks.

We appreciate the time Sean, Kimberley and Randy took to speak with us. If you want to share your experience using multiple constellations, let us know by posting your thoughts on Twitter and Facebook using the hashtag #TrimbleConstellations. ■

Part of the LSU C4G RTN network, this enclosure in the middle of Lake Borgne, La., holds two gel cell batteries, a solar charger, cell modem, cell booster and a Trimble Alloy GNSS reference receiver.

Sean Fernandez is a registered professional land surveyor in the state of Utah. He stays closely engaged in the surveying community by managing the Statewide GPS Network, helping protect and maintain the Public Land Survey System, and acting as the National Geodetic Survey (NGS) state coordinator for Utah.

Kimberley A. Holtz, a professional geologist and land surveyor, has more than 30 years of land surveying experience in both private and public sectors. She is currently chair of the California Spatial Reference Center, a director and educational chair for the California Land Surveyor Association and treasurer of the League of California Survey Organizations.

Randy L. Osborne is a research specialist and the administrator of CORS and real-time networks at LSU's Center for GeoInformatics (C4G). He has been instrumental in generating funding for C4G through RTN subscriptions and grants for height modernization and geospatial modeling.

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AZ	Civil Designer	Civil & Environmental Consultants, Inc.	Phoenix	2899
OK	Civil Designer	Civil & Environmental Consultants, Inc.	Oklahoma City	3106
TX	Civil Designer	Civil & Environmental Consultants, Inc.	Houston	3192
AZ	Senior Civil Designer	Civil & Environmental Consultants, Inc.	Phoenix	3033
AZ	Senior Design Manager	Civil & Environmental Consultants, Inc.	Phoenix	3209
OH	Survey Assistant Project Manager	Civil & Environmental Consultants, Inc.	Cincinnati	3177
WV	Survey CAD Technician	Civil & Environmental Consultants, Inc.	Bridgeport	3207
TN	Survey CADD Technician	Civil & Environmental Consultants, Inc.	Franklin	2456
OH	Survey Principal	Civil & Environmental Consultants, Inc.	Toledo	3180
OH	Survey Project Manager	Civil & Environmental Consultants, Inc.	Columbus	2704
PA	Survey Project Manager	Civil & Environmental Consultants, Inc.	Pittsburgh	3083
IN	Professional Surveyor	Civil & Environmental Consultants, Inc.	Indianapolis	2622
IN	Professional Surveyor	Civil & Environmental Consultants, Inc.	Indianapolis	3202
PA	Survey Technician	Civil & Environmental Consultants, Inc.	Monroeville	2791
IN	Survey Technician	Civil & Environmental Consultants, Inc.	Indianapolis	2900
OH	Survey Technician	Civil & Environmental Consultants, Inc.	Cincinnati	3173
OH	Survey Technician	Civil & Environmental Consultants, Inc.	Columbus	3227

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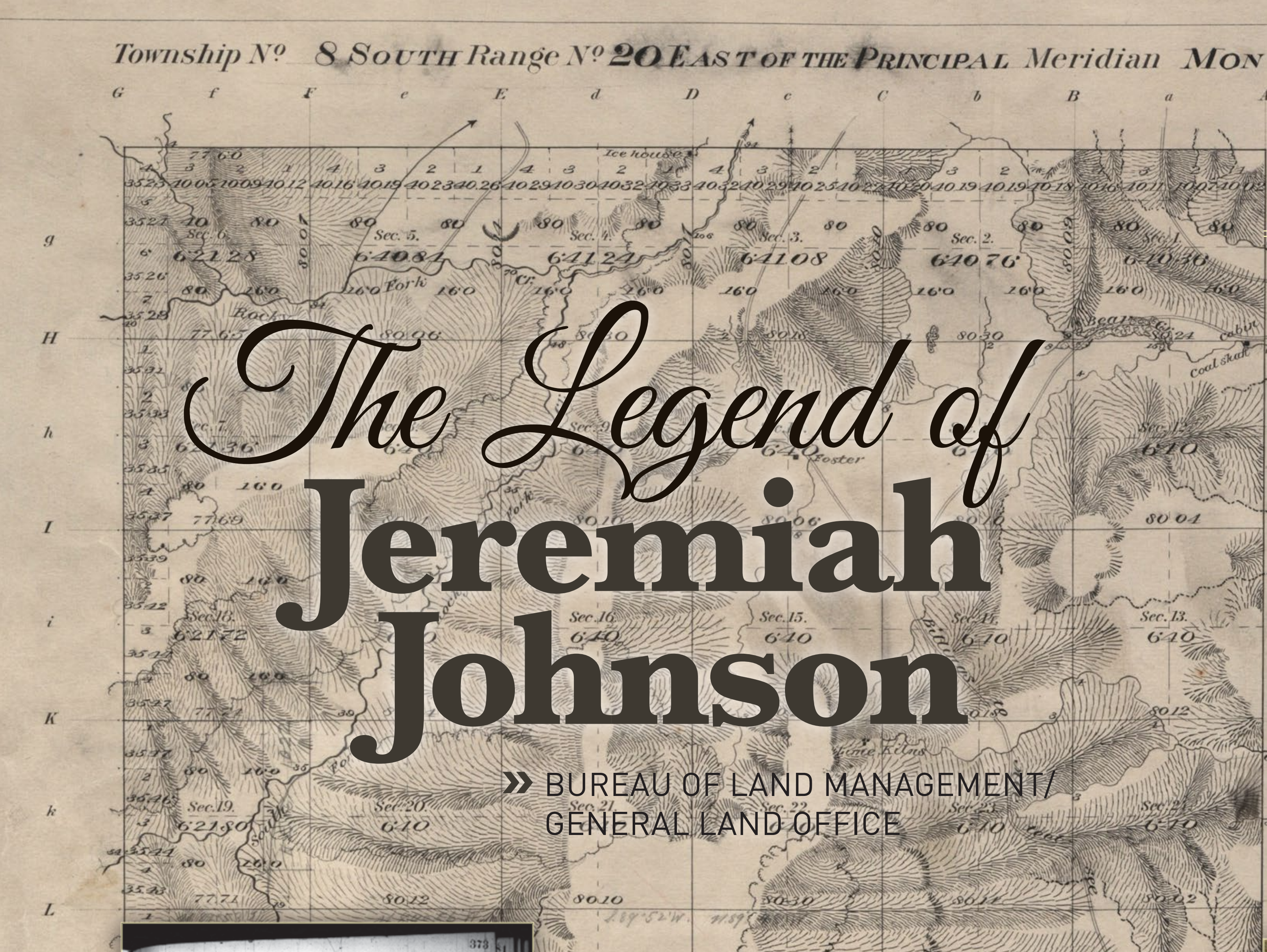
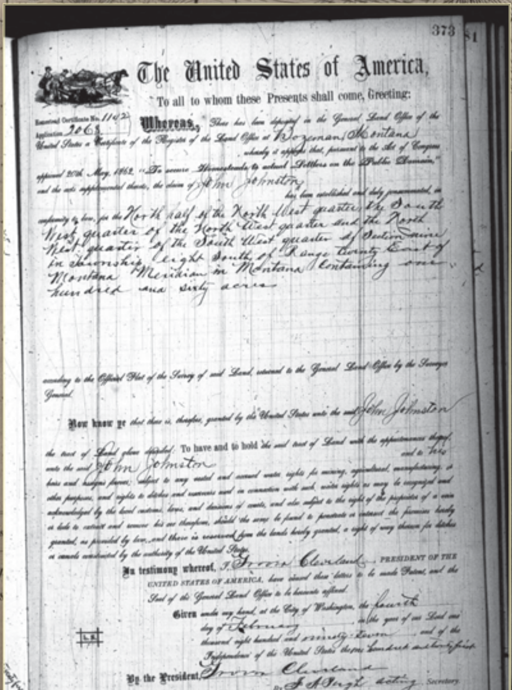
NJ	Crew Chief / Jr. Crew Chief	Surveying And Mapping, LLC	Moorestown	20-3484
NJ	Instrument Operator	Surveying And Mapping, LLC	Moorestown	20-3483
OH	Survey CAD Technician II	Surveying And Mapping, LLC	Westerville	20-3439
OH	Instrument Operator	Surveying And Mapping, LLC	Westerville	20-3422
OH	Staff Surveyor	Surveying And Mapping, LLC	Westerville	19-2859
SC	Senior Crew Chief	Surveying And Mapping, LLC	Columbia	20-3479
SC	Rod Person	Surveying And Mapping, LLC	Columbia	20-3461
SC	Instrument Operator	Surveying And Mapping, LLC	Columbia	20-3430
TN	Staff Surveyor	Surveying And Mapping, LLC	Knoxville	20-3482
TN	Survey Project Manager (Tennessee RLS)	Surveying And Mapping, LLC	Smyrna	20-3464
TX	Construction Survey Project Manager	Surveying And Mapping, LLC	Dallas	19-3300
TX	Survey Project Manager/RPLS	Surveying And Mapping, LLC	Dallas	19-3299
TX	Staff Surveyor	Surveying And Mapping, LLC	Houston	20-3467
TX	Project Manager (Professional Engineer)	Surveying And Mapping, LLC	Houston	20-3453
TX	Texas RPLS/Senior Project Manager	Surveying And Mapping, LLC	Houston	20-3446
TX	CEI Regional Manager	Surveying And Mapping, LLC	Rio Grande Valley	20-3438
TX	Crew Chief	Surveying And Mapping, LLC	San Antonio	19-3390



The Legend of Jeremiah Johnson

» BUREAU OF LAND MANAGEMENT/ GENERAL LAND OFFICE


373

The United States of America,

To all to whom these Presents shall come, Greeting:

Homestead Certificate No. 1142
Application 2068

Whereas, There has been deposited in the General Land Office of the United States a Certificate of the Register of the Land Office at Bozeman, Montana whereby it appears that, pursuant to the Act of Congress approved 20th May, 1862, "To secure Homesteads to actual Settlers on the Public Domain," and the acts supplemental thereto, the claim of John Johnston has been established and duly consummated, in conformity to law, for the North half of the North West quarter, the South West quarter of the North West quarter and the North West quarter of the South West quarter of Section nine in Township eight South of Range twenty East of Montana Meridian in Montana containing one hundred and sixty acres

according to the Official Plat of the Survey of said Land, returned to the General Land Office by the Surveyor General.

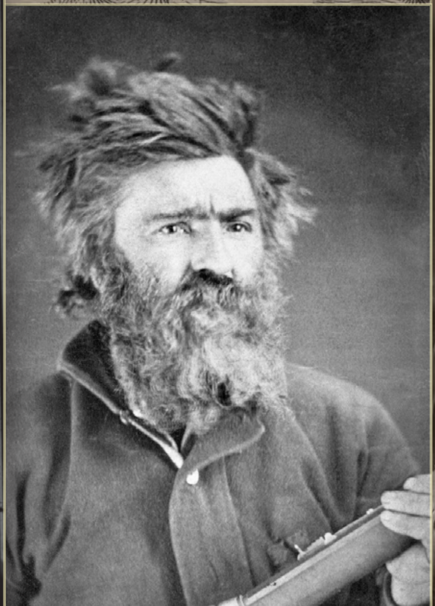
Now know ye that there is, therefore, granted by the United States unto the said John Johnston the tract of Land above described; To have and to hold the said tract of Land with the appurtenances thereof, unto the said John Johnston and to his heirs and assigns forever; [illegible]

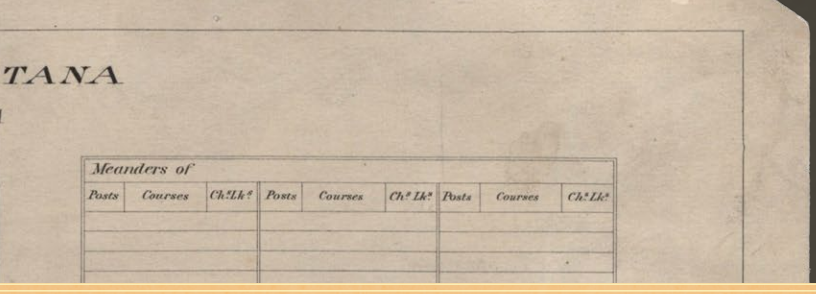
In testimony whereof, I, Grover Cleveland, PRESIDENT OF THE UNITED STATES OF AMERICA, have caused these letters to be made Patent, and the Seal of the General Land Office to be hereunto affixed.

Given under my hand, at the City of Washington, the fourth day of February, in the year of our Lord one thousand eight hundred and ninety-seven, and of the Independence of the United States the one hundred and twenty-first.

L.S.

By the President, Grover Cleveland
By F. A. Pugh acting Secretary.
L. E. Lamar, Recorder of the General Land Office.





This General Land Office Record of the Week is based on a legendary Wild West character, Jeremiah Johnson. You may have heard of Johnson through the 1972 film starring Robert Redford. But more important, Johnson's personal history is revealed through records in the GLO collection.

A Brief Stint in the Navy

There are many stories behind the man. Depending on who you ask, some are true and some are not. Johnson himself was also known to perpetuate his own rumors, which doesn't help historians. Jeremiah Johnson was a name concocted for the movie, but his real name was John Johnston, one he gave himself after being kicked out of the Navy for striking an officer during the Mexican-American War.

Heading to the Mountains

After his expulsion from the Navy, Johnson headed to the mountains in search of a life of solitude. As the story goes, his first stop was a cabin on the Little Snake River in northern Colorado. He honed his trapping, hunting, and survival skills with a more seasoned mountain man that he had befriended, Old John Hatcher.

After developing the necessary skills to survive in the wilderness, Johnson headed out on his own. During his travels, he married a native of the Flathead tribe and began to settle into his new life.

However, we wouldn't still be telling his tales if Johnson had simply lived out his days as a mountain man. Legend has it that his pregnant wife was murdered and scalped by the territorial Crow tribe while he was out hunting. This led to Johnston seeking great revenge against the Crow.

Conflict with the Crow Indians

Johnson's legendary confrontation with the Crow gained him much notoriety, as he is famed to have gone on a years-long rampage throughout the Northern Rocky Mountains, slaying many of his adversaries along the way. Whether that's true or not will depend on which version of the story you believe.

Settling Down in Montana

It's said that after all the bloodshed, Johnson and the Crow made amends. Johnson then headed to Red Lodge, Montana, where he earned title to 160 acres under the authority of the Homestead Act of 1862, and lived the latter part of his life as the town Constable.

Through all the hearsay, what is certain is that John Johnston's patented land is documented on the GLO website in Township 8 South Range 20 East, just south of Red Lodge.

More info here:

- *https://www.damninteresting.com/liver-eating-johnson/*
- https://www.greatfallstribune.com/story/outdoors/2017/09/12/legend-liver-eating-johnson-keeps-getting-taller/657762001/

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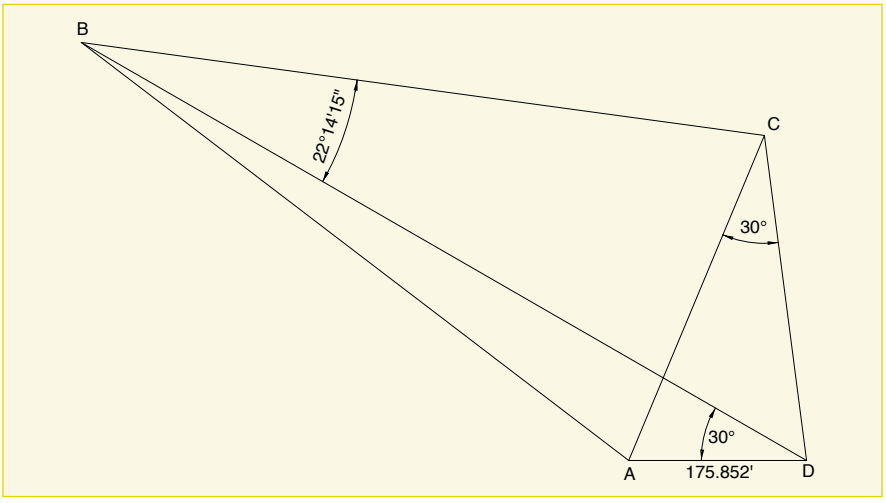
For the solution to this problem (and much more), please visit our website at: *www.amerisurv.com*. Good luck!



Dave Lindell, PS, retired after 36 1/2 years with the City of Los Angeles. He keeps surveying part time to stay busy and keep out of trouble. Dave can be reached at *dllindell@msn.com*.

Lathrop, *continued from page 40*

island, while some traffic circles allow pedestrian access to that inner circle, often via a signalized crosswalk or, a la Arch of Triumph, an underground passageway. As for parking, it is prohibited at roundabout entries or in the circulatory roadway, but allowed in some traffic circles. Finally, the direction of traffic is counter-clockwise in roundabouts, passing to the right of the central island, while some traffic circles allow vehicles to turn left just before entering the circle.

Additional design elements may apply to roundabouts. At vehicular entry points, splitter islands separate entering and exiting traffic while serving to slow down entering traffic (and providing a refuge for pedestrians). Entry ways may also include flares, widening the approach to multiple lanes to allow for additional traffic capacity both inside the roundabout and in the line of vehicles waiting for entry.

The planning and design of roundabouts merited several documents from the Federal Highway Administration. "Roundabouts: An Informational Guide" (Publication FWHA-RD-00-067, available online at *https://www.fhwa.dot.gov/publications/research/safety/00067/00067.pdf*) comprehensively addresses everything from planning to community outreach to traffic operation to landscaping to geometric design. It also cites safety statistics (for euphemistically named "conflicts" and more directly addressed crashes) for a variety of circumstances, including lessons learned from European counterparts. A shorter single point document is entitled "Roundabouts: A Proven Safety Solution that Reduces the Number and Severity of Intersection Crashes" (Publication FHWA-SA-10-005, Intersection Safety Brief 14, downloadable from *https://safety.fhwa.dot.gov/intersection/other_topics/fhwasa10005/brief_14.cfm*)

Keep in mind that the regularly-shaped roundabouts primarily described in these documents are not the only designs we may be called upon to survey and lay out. They may not even all be at the same elevation: see the elevated pedestrian roundabout in Shanghai, China, which gave me vertigo but fantastic views.

Then there are "dog bone" roundabouts, which look like circles squeezed in the middle, and "dumbbell" roundabouts with two roundabouts connected by parallel traffic lanes. Configurations new to me are "hamburger" roundabouts in which the center island is crossed by the main road, "turbo" roundabouts with raised lane dividers or markings to keep drivers in their lanes, and "flower" roundabouts with slip lanes for right-hand turns. For more on these variations, see the National Motorists Association e-Newsletter posted at *https://www.motorists.org/alerts/is-it-the-golden-age-for-roundabouts-nma-e-newsletter-367/*. Those of us who weren't fond of calculating spirals may need to brush up on those skills to accommodate new traffic control construction. ■

Wendy Lathrop is licensed as a Professional Land Surveyor in NJ, PA, DE, and MD, and has been involved since 1974 in surveying projects ranging from construction to boundary to environmental land use disputes. She is a Professional Planner in NJ, and a Certified Floodplain Manager through ASFPM.

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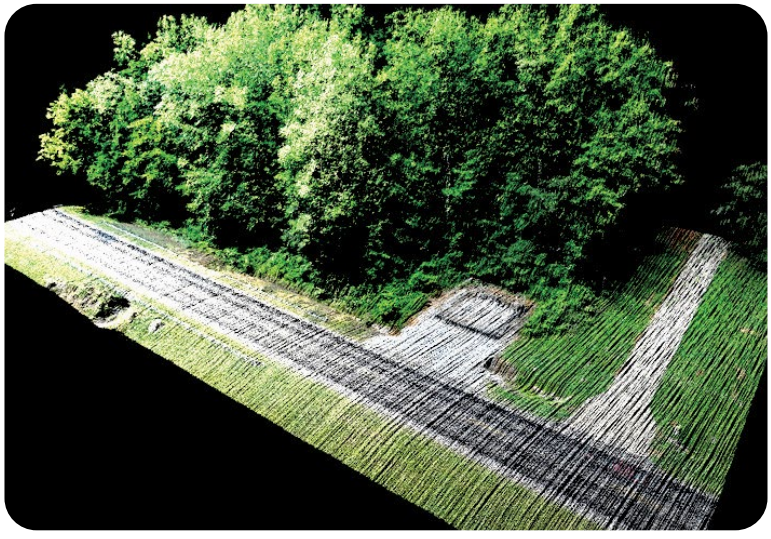

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The Roundabout Evolution of Traffic Circles

In college, my friends and I loved listening to a spoof called "The Never-Ending Traffic Circle" by Firesign Theater about a driver who couldn't seem to find his way out to the other side. Not everyone had experienced one of these traffic calming and regulating wonders, but they all understood the concept. I, on the other hand, had driven them in New Jersey, where they eliminated the need for traffic signals, easing traffic into continuous motion without the need to stop (yielding still was required) and slowing traffic across the confluence of multiple intersecting roadways. For those who aren't sure they have seen a traffic circle is, look for aerials of Paris' Arch of Triumph, which is encircled by eight traffic lanes connecting twelve intersecting roads.

Traffic circles can trace their American origins to Pierre L'Enfant's street design for Washington, DC in the 1790s, allowing avenues running on a grid to intersect others coming in from 45-degree angles. Dupont Circle is possibly the most well-known of these. More than a century later, New York City gained its famous Columbus Circle. After a big surge in engineering popularity in the 1930s, circles fell out of favor due to being deemed dangerous because drivers didn't properly yield. At the time, entering traffic had the right of way and traffic in the circle was supposed to yield. Giving priority to incoming traffic can allow more vehicles into the circle than it can handle, resulting in congestion and more likelihood of crashes as a result of both crowding and impatience. In response, some places replaced traffic circles with traditional signalized intersections.

But it's time to put our geometry caps back on, because variations on traffic circles (also called rotaries) have been making a big comeback. Reversing who yields and who keeps going has made a big difference in safety: those entering now must wait. Still, not everyone loves them, as they can be confusing to enter and exit until used to them. The evolution from rotaries to what are now called roundabouts is infiltrating both residential and urban roadscapes, so refreshing our understanding is in order.

The Mingzhu roundabout in Shanghai ranks high on my list of artistry in engineering and design.

Roundabouts and traffic circles differ in several ways. On roundabouts, traffic control is by giving priority to circulating vehicles and making entering vehicles yield, while some traffic circles use stop control at one or more entries, and in some instances may still require circulating traffic to yield to incoming vehicles. Roundabouts allow pedestrians only to cross the intersecting roads, or legs, essentially prohibiting access to the central

continued on page 38

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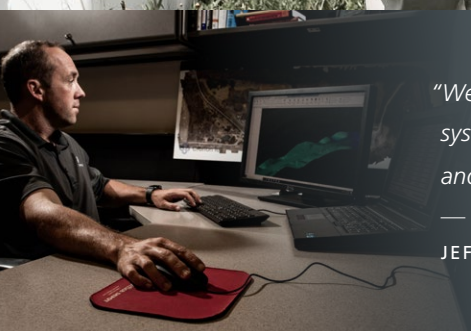

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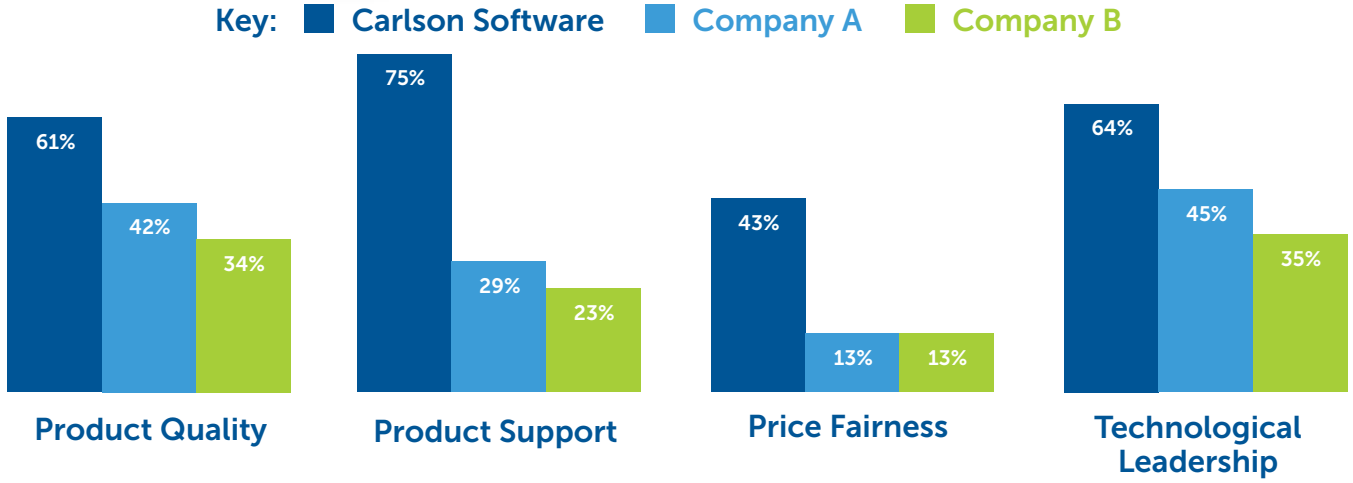

Top Box % Excellent*(among users of CAD software who are aware of CAD software brands and have purchased that brand in the last 12 months). Q7b1-b4. Please rate the following brands of CAD software on how they perform in Technological Leadership / Price Fairness / Product Support / Product Quality. [Select one for each] "Don't know" responses have been removed. * Data shown for brands >10% with an n-value>20. 2018 Surveying & Mapping Industry Software Study Copyright © 2019 by Clear Seas Research. All Rights Reserved.

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