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Professional Surveyors and Utility Locations

Surveyors are frequently faced with utility-related issues that, if not resolved adequately, can result in a negligence claims accompanied by inordinately high liability. Whether the concern is showing utility locations as part of a design survey, setting monuments in close proximity to a buried utility or locating sub-surface infrastructure in preparation for excavation, the problem of obtaining accurate utility locations is pervasive.

Nationwide 811 calling for utility locates was designated by the Federal Communications Commission in 2007 as part of the culmination of an effort to identify best practices through the Common Ground Study. That study was mandated by the Transportation Equity Act for the 21st Century (TEA 21) passed by Congress in 1998.

The study was conducted by the Office of Pipeline Safety (now the Pipeline and Hazardous Materials Safety Administration) and involved representatives from electric, water, sewer, cable TV, oil and gas transmission and distribution, telecommunications, railroads, excavators, design engineers, regulators, location service providers and local, state and federal government. One result of the study was the establishment of the Common Ground Alliance to further the damage prevention effort on an on-going basis.

The 811 location service is called by a variety of names including Julie (Illinois), MissDig (Michigan), DigLine (Idaho), Gopher State One Call (Minnesota), Sunshine 811 (Florida) and, most commonly, [Your State Name] 811. While each state has its own specific set of laws, some offer exemptions and optional location services that might offer some relief to professional surveyors when excavation is not pending.

Depending on what state a surveyor is working in, an 811 call might not be required at all, or might be mandatory with no exceptions. For example, in Illinois, excavation requiring an 811 call does ***not*** include *"land surveying operations as defined in the Illinois Professional Land Surveyor Act of 1989* ***when not using power equipment****…"* [emphasis added], yet in Indiana, surveyors have been told in no uncertain terms that anything driven into the ground more than 1 inch requires an 811 request with absolutely no exceptions.

Notwithstanding all of this, surveyors—on a fairly regular basis—drive rebars/irons through gas and other utility lines, so they cannot claim they are inculpable and that they should be exempted from the law. Yet, 811 calls for surveys often result—at best—in incomplete responses.

One step that states have made is to create a "design ticket" request that can be used to obtain information for planning and design when excavation is not imminent. There are, however, tradeoffs when requesting a design locate such as a longer time period for locators to respond and limitations on such things as requests for re-marking and on how many design requests can be made in the same location.

In consideration of all of this and acknowledging the need to document accurate locations of utilities during the design process, the American Society of Civil Engineers (ASCE) developed National Consensus Standard ASCE C-I 38-02: *Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data*. This standard outlines the attributes of Quality Levels D through A, with D being the least comprehensive and A representing the most thorough investigation of the standard.

A new Colorado law requires that a licensed professional engineer designing a government "subsurface utility engineering-required project" must submit a location request to Colorado 811 during the design phase. With regard to utility locations, the law mandates that the project plans meet the ASCE Quality Level B criteria, using

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the American Surveyor

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THE **ONE** THAT STARTED IT ALL

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JASON E. FOOSE, PS

decided guidance: case examinations

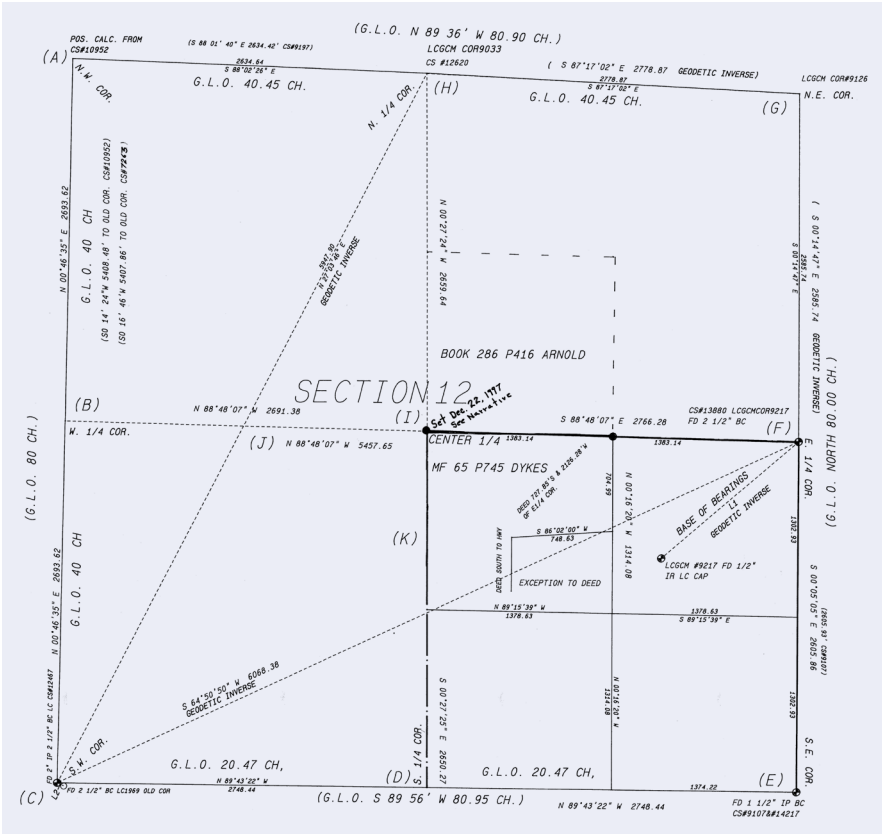
Dykes v. Arnold

Several years ago I wrote to *The American Surveyor* and asked old man Cheves why, if double proportioning is a last resort, is it one of the first things a surveyor is taught? In fact, it takes less time for me to implement this federally inspired recipe for disaster and wreak havoc all across private lands than it does to lawfully apply for a special recreation permit to access the federal lands for which it was intended. The courts have continually rejected the method as a substitute for original evidence. That leads us to Oregon and the case of *Dykes v. Arnold*.

> "The two surveyors took dramatically different approaches to the task."

The court didn't lollygag around and quickly set the scene with *"The two surveyors took dramatically different approaches to the task."* In a nutshell, we have a proper boundary retracement survey competing against an unauthorized re-subdivision survey a.k.a. double proportion. The court summed up the proper retracement like this *"Defendant's surveyor, Nyhus, aware that the center had been surveyed and marked ("monumented") in 1899 by the Lincoln County Surveyor,*

attempted to locate the center as set by that survey. He believed that he succeeded and that the section's center, as set in 1899 by the county surveyor, Derrick, coincided with the accepted boundary lines in the area as reflected by the deeds, county road location, fence lines, and lines of occupation of the last 100 years". The court's wording sounds so symphonic to me. It's almost as if they were all surveyors. The court further describes the unauthorized re-subdivision of section like this *"**Plaintiffs' surveyor, Denison, made no effort to retrace that prior survey because he thought it was flawed in its methodology. He therefore set out to locate the center anew, using the legally prescribed methodology** and modern survey techniques and disregarding any evidence of the boundaries as reflected in the deeds, fence lines, county road location, and lines of occupation."* That's my emphasis added



See full-size images at:
archive.amerisurv.com/docs/P1j.jpg
archive.amerisurv.com/docs/P2j.jpg

to the part where we see the unauthorized subdivision originate.

The court lays down a sequence of events surrounding the chain of title. "*The first grant of land in section 12 to private ownership was made in 1876. The GLO conveyed the full southwest quarter of the section…to Eugene Adams. The conveyance described the land as the "South West quarter of Section Twelve" according to "the official plat…(also) In 1876, the southeast quarter was conveyed to Thomas Adams. Eugene Adams evidently conveyed…the southwest quarter to C.H. Williams sometime before 1897. Then, in 1897, C.H. Williams conveyed…the "southwest quarter" to David H. Williams… in April 1899, the Lincoln County Surveyor, Z.M. Derrick, performed what is the first recorded survey of the interior of section 12.*" So we have both the southwest and southeast quarters described in conveyances but the common corner apparently had not been established on the ground until a few decades later.

Chad Erickson covered this case for *The American Surveyor* a few years back. This initiated some debate between Chad and a reader named Steven Patterson who at the time was a first year law student and

The Barbershop Barrister

So when should I use double bubbling? My guess is close to never in the course of a retracement survey and even closer if your paycheck is not from the U.S. Treasury. Pulling a double whammy in the federal sandbox is appropriate and a good answer to an anomaly that exists under federal authority. The method is an equitable redistribution of measurements provided under a consistent set of instructions and it's an ingenious solution within a collective domain.

On the other hand a successful boundary retracement in the non-federal arena must reconcile the evidence of conveyances to be effective. Retracement includes perpetuating evidence that marks the boundaries of competing chains of titles. Notice of a deed or patent is related with marks often established by independent parties. This could include discovering evidence leading to a reasonable construction* of their connection. Why doesn't double bubbling fit here? Because your fresh double dinger is a remedy, not evidence ya' nitwit. A lost corner is rare and is the conclusion of a retracement survey. After that conclusion is made, an authoritative action must take place to resolve the private ownership issue and restore the public reliability of the corner. I would not expect a land survey alone to satisfy either or both needs. However, and I'll give you double troublers some credit for this, winging by the numbers out across the lily fields of harmony has served to smoke out some good testimony in the courtroom. Look what we found in Boerst (Wisconsin), Atwell (Washington), Wacker (Arizona), Tresemer (New Mexico), Lee (Alaska), Dittrich (Minnesota), and of course Dykes in Oregon.

Again, so when should I use the double proration method? My best answer is probably when preparing a recorded boundary agreement in the absence of any evidence or agreement between owners and with authoritative notice deeming the original corner as lost. When I say "authoritative notice" I'm not just talking about your note on your survey. At this point we may be dealing with a formal mitigation, perhaps soliciting the public for evidence through formal advertising, deposing experts, and maybe even petitioning your county or court on behalf of the public. There's more to it than tossing out a rectangular grenade and walking away. That's just domestic terrorism with a COGO dirty bomb. Our value lies in recovering evidence that satisfies a reasonable construction* to the interested public.

So I've asterisked "reasonable construction" because I don't want any confusion with any defined legal standard of care. It's a homespun phrase used in this article to describe our subjective judgement. On that topic and using the corner record from the Dykes survey: *archive.amerisurv.com/PDF/MON_PED.pdf*

1. Does the evidence lead to a reasonable construction of the position of the section corner?
2. How many different positions were accepted as the corner?
3. Does the record lead the interested public to reasonable notice of the original position?
4. Could the record lead to a reasonable construction of otherwise valid or bona fide corners in alternate places throughout the section?

LSIT. His education enabled him to provide some legally solid insight and judicially joust with Erickson. The exchange was well founded and just good old fashioned fun to watch. Well, we're not lawyer folk and we're not going there with Dykes. Instead, we're gonna look directly at the competing surveys and smoke the polecats out from under the porch.

Charles Denison (1929-2010) was a good Surveyor. It's apparent from his work. He was precise, thorough, and refined. He was working for Dykes and was familiar with the history and area. He describes a few wounds on his survey that could fester up and gangrene without immediate attention...and sure enough they did in the form of a lawsuit. In the thick of battle we sometimes don't realize these symptoms until it's too late but in hindsight we have in front of us some major SDRs (stop, drop, and roll). Chuck's narrative describes "***The position for the new west one quarter was calculated by proportionate measurement, for the subdivision off the section...***" Whoooaaa there, a "new" west one quarter? Where's that coming from and what's wrong with the existing one? Feeling the need to re-do existing work should be more unnerving than relieving. Furthermore, why would a contemporary surveyor need to subdivide the section in the first place? It was already subdivided by deeds and various surveys. We are now looking for evidence of how those conveyances were laid down, so ask yourself "is the corner evidence effective with those conveyances?" The pie has already been cut; the real question is "how and where?"

Another SDR pops up as the statement continues. Just to clarify I have broken Chuck's statement and inserted my comments right at the itchy spots. Continuing on "... ***as the monument set by C.S. #7263 was proportioned from the erroneous position of the southwest corner.***" This highlights the tawdry exercise of stacking proportionate restoration on common law corners in the non-federal arena. If the first ring dinger wasn't good enough how is a "re-bubbling" going to be any better? Common law narrows retracement toward the observation of existing evidence. Introducing an alternate or unnoticed position is contrary to that charge. Ask yourself "has anyone ever had the opportunity to actually rely on my newly created position?"

Geodesy can be the Salem Witch Trial of retracement surveying. Accusing a corner of being at some intangible computed position is like Elizabeth Hubbard screaming "witch" and the courts relying on the misguided science of drowning as evidence. ***"The positions of the northeast corner, and the north one quarter corner were computed from geodetic inverse of published L.C.G.C.M. coordinates."*** Geodetic computations and inverses are theoretical and do not serve notice to landowners without marks. Ask yourself "what opportunities did the witnesses have to understand this position?"

Chuck continues his concerns with ***"The position of the south one quarter corner was proportioned as in previous surveys."*** Okay? What evidence do we have to tie the position reliably to a conveyance? We know that the southwest corner was erroneously pinned to alternating positions. The rubber band of righteousness has just snapped under the instability of southwest corner. There is a period of time when conveyances and surveys could have relied on either position of the southwest corner. I am breathing uneasy and think it's time to SDR.

Despite all of the witchcraft, science, and geodesy that aristocrats might call "learned measure", common property owners have an understanding of their boundaries and an obligation to defend them. Denison was rammed, then spun out and hit the wall in turn number four as noted in his final statement. ***"Survey as of this date has set the C.E. 1/16th corner but crew was unable to set the center ¼ corner, ties to fence lines, or search for evidence of the center ¼ corner, as person representing himself as owner to the north demanded that the crew leave and pulled out the stakes and survey control monuments which were established to set the center ¼ corner."*** Something is grossly wrong here. These owners might just be tabacky chewin' moonshine crazed hill folk thinkin' you're a revenuer man but these folks might also actually know something you don't. There's a good chance that their knowledge and standing trumps a double whammy in the hierarchy of precedence. Furthermore ignoring their challenge seems like a denial of their opportunity to disclose evidence to your client.

Denison did a thorough job and the survey itself is extremely retraceable. There's plenty of solid measurements and calls for monuments. His research was deep and cleanly incorporated with record references. The methods leading to his decisions are clearly expressed in his narrative and notes. So how can something this good not win in court? I think the court identified it best with *"Denison made no effort to retrace that prior survey because he thought it was flawed in its methodology."* It's apparent to me that Chuck did his best to make things work according to the B.L.M. rules and standards he was taught. Unfortunately the prior surveyors employed alternate methods that ripened and an honestly mistaken bearing tree at the southwest corner of the section didn't help matters either. I encourage everyone to pay their respects to Chuck Denison as a good surveyor and visit his obituary at *https://bit.ly/2Fo1q5w*

Next month we'll breakdown the Nyhus survey and see what groceries we can bag. Gary Nyhus is alive, kickin' and still dangling his bob in the Oregon sea breeze. He mentioned one of his great mentors around Lincoln County, Oregon, by name and asked if I might know of an old surveyor named Robert Dahl? That's like asking if I've ever heard of a band called "The Beatles," right? Feel free to drop me a line at *rls43185@gmail.com* ■

SELF-STUDY GUIDE (References)

Google the following search terms to find the article references:

- Dykes v. Arnold 015185; a121699 Oregon
- Wirostek v. Johnson, 266 Or. 72, 75, 511 P.2d 373
- Reed v. Tacoma Bldg & Sav. Ass'n, 2 Wash.198, 202,26P. 252, 252-253
- McDowell v. Carothers, 75 Or. 126, 135, 146 P 800
- ORS 93.310
- Mason v. United States 260 U.S. 545, 558, 43, S. Ct. 200, 67 L. Ed 396. (This ties to footnote 14 in Dykes decision).

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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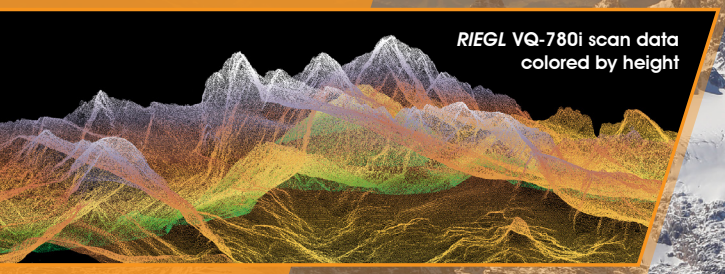

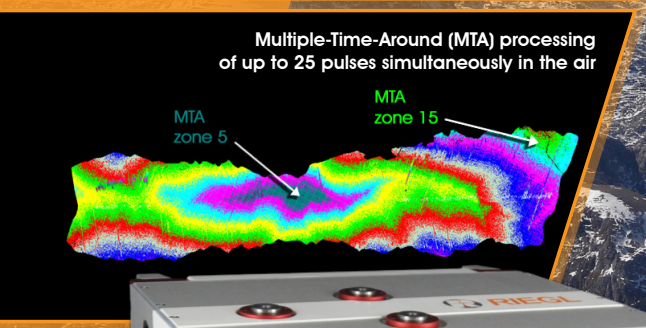

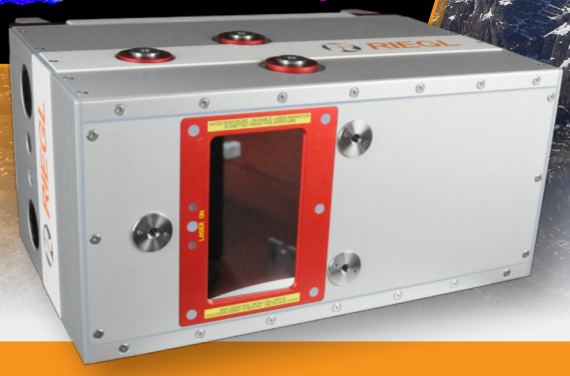

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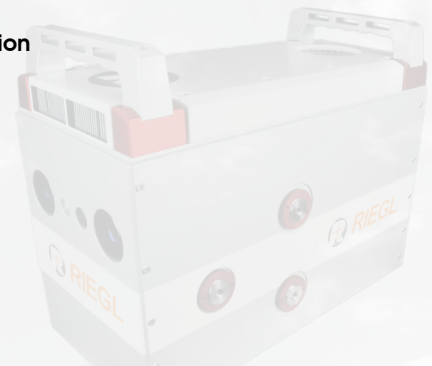

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JASON E. FOOSE // PS

product review

The normal challanges found in urban canyons bustling with RF interference, traffic, people, and structures are no match for Hybrid+ robust dual geodetic solution capability.

Carlson Hybrid+

According to the futurist Daniel Burrus there's a visible future if you know how and where to look. That's precisely the warm and fuzzy I had while visiting with the forward thinkers of Carlson Software. As we approach the third decade of the millennium we find ourselves immersed in a new business climate bursting with opportunities driven by technology. The great recession has had a huge influence on our equipment lockers. Global engineering companies maintain large and amalgamated fleets of every color, brand, and type of measuring device available in every regional market. Regional mid-size firms are willing to invest in cutting edge systems but often carry a strong backlog of second string equipment assumed in mergers or local buyouts. The "small potatoes" firms realize their bang for the buck by purchasing the most cost-effective and compatible platform with their existing rig. And then there's government procurement which undoubtedly will buy purple when you spec out yellow, blue, or green. The reality of our business is that equipment lockers look like boxes of Crayola crayons and our crews need to use every color to be effective. "Cross-color" compatibility requires the equipment manufacturers to develop in open-source by sharing their "nuts and bolts".

That leads us to Carlson Software, Inc. with their flagship solution SurvCE/PC 6.0 data collection package. I was able to test drive the latest version on a Carlson RT3 ruggedized tablet running a Carlson CR+

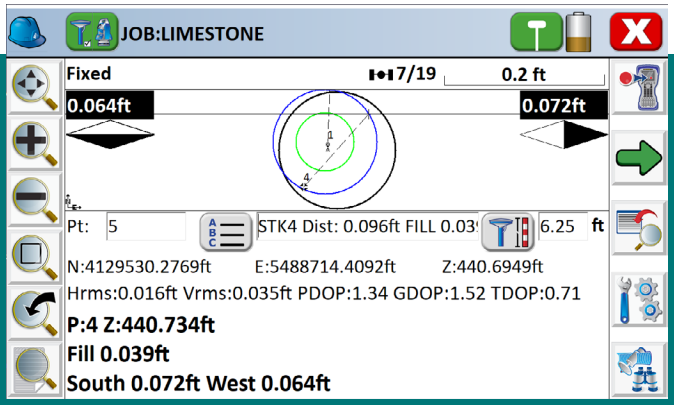
Trains are "pains" to surveyors. Hybrid+ captures terrestrial shots with clear lines of sight and easily flips to GNSS collection when the train crawls by or worse yet stops in the siding.

Robotic TS (RTS) and a soon-to-be-released Carlson NR3 GNSS receiver interfacing with a local RTN. SurvCE naturalized these global components into a native system that seamlessly behaved as if it were proprietary and all one color. Carlson has the largest library of available drivers in the world. I'm sure there's a few "secret sauces" in the industry but a glance at the available drivers list really does cover most every reputable manufacturer peddling survey gear. Manufacturers learned from the early auto industry that cross-licensing and open source strengthen an industry. Contemporary OEM's of global/terrestrial positioning systems have traditionally subscribed to the principal and the result is a healthy market and innovative products.

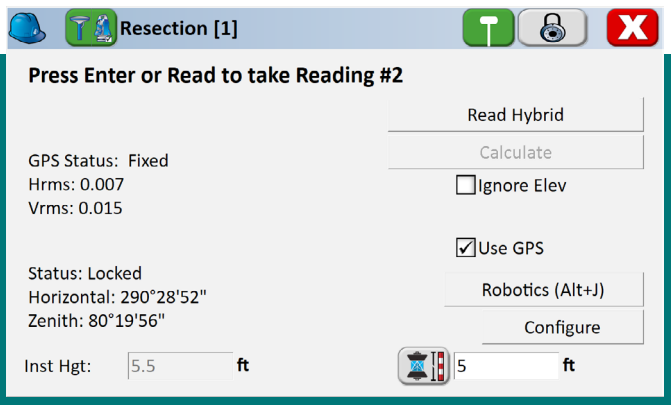
The **Hybrid+** solution is one of those innovative products incorporated into SurvCE/PC. **Hybrid+** features a dual reading capability that synchronizes the terrestrial observation with the GNSS position at the user's discretion. Selecting between measuring systems is accomplished with a simple toggle button on the screen and both are incorporated into the quality control component of **Hybrid+**. User defined tolerances set between GNSS and RTS measurements are analyzed by the software. The user is prompted to store, auto store, or in the event criteria are not met, the shot is flagged for further analysis by the user. This feature readily distinguishes stray reflector shots and poor GNSS conditions. The obvious benefit to having a combined rover and prism pole it that when one system is impaired by the "joys" of working in uncooperative environment, the other is seamlessly available by one simple click of a toggle button. Perhaps a less obvious benefit is that the RTS itself is being guided by GNSS. Regardless of whether or not the RTS is looking at the rover, the system knows exactly where the rover is at all times and simply spins the RTS precisely to the 3D position of the prism. If RTS lock is interrupted, all it takes is the simple tap of a button and reacquisition is faster than I can plumb up. Otherwise lock is maintained through the "follow me" feature. Basically, RTS follows the rover's computed 3D GNSS position with 3-5 second updates. Prism lock is re-acquired nearly instantaneously when the rover motion behaves like it is ready for a shot (steady) or it gets near the stakeout point. There's no need to maintain an optical lock while staking, as the stakeout directions are derived from the GPS position. Needless to say not having a continuous infrared drain on the battery is a big win for power consumption which cuts downtime for battery swaps. Most importantly however, the speed of target acquisition is nothing short of impressive.

Redundancy between GNSS and RTS is obviously a huge quality control feature of **Hybrid+** but which measurement is better? **Hybrid+** offers the flexibility to choose based on the robust qualities of either system. Near the RTS, around canopy, and in urban canyons terrestrial measurements will, as expected, be much tighter than GNSS. The advantage of any brand RTS will radiate according to manufacturer's specifications and well beyond ground zero at the setup. Nearing the effective limits of RTS is an environmental sweet zone where the resolution of both systems will yield similar statistics and the quality is equal. Beyond the reach of equality, the GNSS does the heavy lifting with the typical vigorous RTN statistics we are accustomed to seeing. Again,

Contemporary equipment lockers resemble boxes of Crayola crayons.



The front face of the staking screen offers a truckload of relevant data. GNSS satellite stats, heads-up tilt sensors, come/go/left/right pointers, cut/fill, point data, cardinal guidance, rod height, GNSS positional stats, and of course the Hybrid+ toggle near the upper left. Note the dynamic scale bar showing 0.2 ft as the shot is nailed down.



In Resection, one button push combines the GNSS position precisely timed with the RTS result for robust real-time solutions. Any GNSS/GPS rover position can be a resection control point and the RTS position is precisely resolved relative to the datum pumped out by GNSS, Real Time Networks, or known benchmarks.

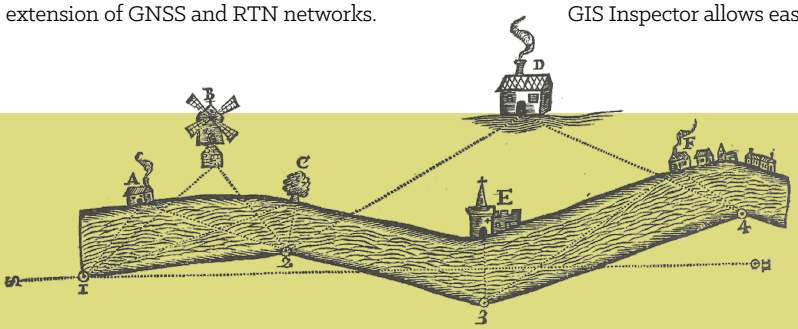
the user simply hits a toggle to select the result of either system as the stored measurement and the other as quality control.

Hybrid+ is the ultimate free stationing solution. The RTS is no longer a slave to hard slab control networks, arbitrary assumed datum, or intervisible monuments. The RTS can be deployed at any convenient spot regardless of overhead canopy, aerial obstructions, and GNSS deal killers like urban canyons. The magic behind **Hybrid+** is the rover's ability to relate its precise geodesy to the RTS through every hole, crevice, cranny, or tunnel on the jobsite. Using the continual real-time position at the GNSS rover, **Hybrid+** computes a geospatially accurate and statistically precise resection solution at the current RTS position. The GNSS constellation itself is the control monument and the rover antenna simply funnels the positional data through the **Hybrid+** controller to the RTS. This truly liberates the robots from being autonomous hubs and employs the RTS as an active extension of GNSS and RTN networks.

SurvCE also has some very nifty features worth a deeper look. My "short list" includes the new voice prompting for stakeout and instrument status. Voice prompting is exclusive to SurvPC 6.0 and allows users to keep focus on a point as well as keep an eye on traffic or heavy equipment. This seems like a "must have" for solo operators. The Tilt Correction routine uses the on board accelerometer and compass sensors to compute a point on a true vertical at the rover. The useable range is an extremely forgiving 15° to 20° out of plumb depending on manufacturer specs. This really speeds up acquisition and compensates for the jitters, sloppy rodsmanship, and shoehorning the shot around obstacles. I was impressed by the accuracy and repeatability of this correction. Web map overlays from Google, Open Street Maps, ArcGIS REST, and user defined Web Map Servers (WMS/WMTS/TMS) are now supported. Capturing data in real-time over good imagery is a windfall for quality control on a project site.

GIS Inspector allows easy viewing of GIS attributes when selecting points in the map, and prompts for attributes when storing points from the map view. Surface Inspector compares plans against as-built elevation differences. The simplified routine helps to identify and express conformance concerns through as-builts in real-time on the job site. Relaying the as-built data through a connectivity package like Carlson Cloud gets those deliverables to the engineer at the speed of lightning.

As smart city technologies become reality our measuring systems will need to facilitate data collection in grossly congested environments of infrastructure, buildings, traffic, humans, and an ocean of RF noise. Carlson SurvCE/PC **Hybrid+** appears to be a frontrunner in mitigating the environmental challenges associated with measuring the spaces where we live and work. Urban terrain is of course the Achilles heel of GNSS. The freedom to conveniently deploy the RTS and compute a resection from any convenient GNSS rover window opens up new opportunities in data collection. **Hybrid+** is a smart tool



John Love's resection methods described in Geodaesia circa 1688 (left). In 2018 Carlson Software combines GNSS and RTS with a simple toggle switch to perform real time GNSS/RTS resections (right).

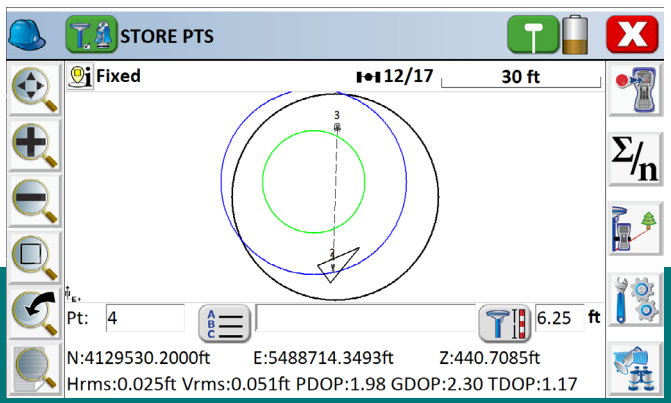
Voice command assists the solo operator in risky environments. The Hybrid+ resection freely allows the RTS to be set up at the most convenient places on a project. Both opportunities are safety multipliers on the jobsite.

for smart city capture with the capability to relate BIM data directly to geodetic datum and national or state plane coordinate systems. Just to add perspective to the aforementioned opportunities, Los Angeles World Airport hosts 84,557,968 annual passengers across 3,500 acres of RF saturated ground. The airport's 2018 Capital Improvement Plan grosses out at $3,948,000,000. I read that as $4 Billion.

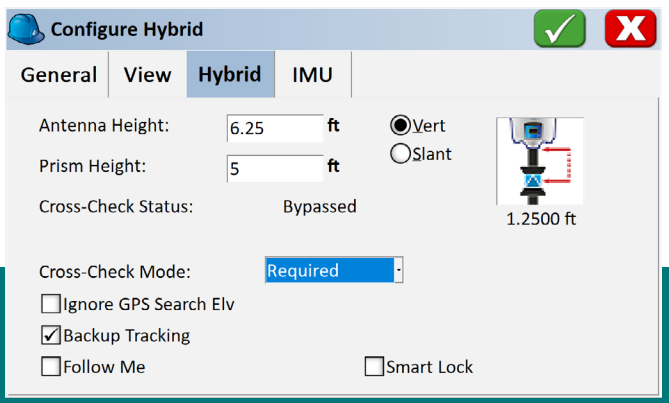
That takes us to the Carlson Cloud command which is an Internet/cloud-based routine designed to easily facilitate sending messages, data files and crew locations between the office and Internet-connected field devices running Carlson SurvCE or Carlson SurvPC. Connectivity is an industrial milestone of biblical proportion like papyrus, the wheel, and the HP35. Carlson Cloud is leading the way with a robust security login including user, account, and company identification keys. Credentialed users are integrated into the connected environment and are identified on the grid. The chat tab connects users under the same company key with the option to select specific players from a drop list or the group at large. A "message area" tab keeps previous chats handy and a chat line delivers quick questions to specific users and groups. Users can exchange data, models, and revisions instantaneous with the job sharing feature. Most exciting to me is that user visibility is selectable on the grid. Integrating your workforce into a client's grid is the forthcoming competitive edge in business and requisite to successful contracting. Remember the previously referenced four billion dollar smart city we call LAX? Collaborating with clients through Carlson Cloud and sharing visibility data is the gateway to automating your billing. Talk about an impartial and accurate tracking system, I don't think it gets any better than using GPS and your client's system login to substantiate billable time. Let that sink in for a minute. Furthermore, visibility data is extremely valuable to the "host grid" managers running day to day logistics. For example, those LAX folks can coordinate your team activities according to traffic swells, trends, and security events. This is a game changer folks.

Smart cities are fueled with data and we are primary suppliers. We work in a time when our skills and opportunities are very portable. Both expanding markets and a migratory workforce require great flexibility in choices of hardware, software, platforms, and systems. The bottom line is achieved by deploying any color combination of assets with every human resource at any spot on the globe. Carlson has taken a queue from the automotive industry and combined the best contemporary industrial components with **Hybrid+** in order to leverage the strengths of all systems. The team at Carlson Software has once again pushed the technological envelope beyond industrial constraints and is redefining the way we work. ■

Jason Foose is a Professional Surveyor licensed in multiple jurisdictions.



Storing points in GNSS mode offers the positional statistics out front, the satellite stats on top, and the heads-up tilt sensors are clear and easy to read. Should GNSS be interrupted the RTS can be spun directly to the prism with the Hybrid+ toggle and search.



The system is configured to aim precisely at the prism from the offset between the GNSS antenna. Cross-Check is required and was manually bypassed on the previous shot. The Cross-Check feature ensures robust and appropriate results prior to storing by comparing RTS and GNSS observations and user-defined tolerances.

Break

ing Down Borders

Engineering students use geospatial technology to help third-world communities access water

Christian Brodbeck is standing in a small village in western Rwanda. It's hot and dry. There is no air conditioning in the buildings and no breeze outside. Actually, there isn't any running water or electricity either. And, of course, no WiFi. Yet Brodbeck is receiving some of the highest accuracy positioning data possible in a region as remote as any in the world.

"It's mind-boggling to me that I am out in the middle of nowhere and this piece of equipment is getting amazing accuracy," Brodbeck says.

Brodbeck is using a Trimble® R2 GNSS receiver and Trimble CenterPoint® RTX satellite-delivered correction services, a powerful combination that lets users perform positioning fieldwork in the most remote locations without relying on traditional VRS networks or a local RTK base station.

Trimble R2 is a compact, durable GNSS receiver that provides an easy-to-use solution for GIS and survey professionals to collect precise data in a range of geospatial applications. The R2 supports real-time time correct services, with CenterPoint RTX capable of delivering accuracy of 2 centimeters horizontal and 5 centimeters vertical.

Helping Developing Communities

For the last two summers, Brodbeck has spent two weeks in Rwanda where he and six students from Alabama's Auburn University get up at dawn to install water distribution systems in underdeveloped communities. The project is part of Engineers

» KRISTINE CARBER-WHITE

Christian Brodbeck and students with Engineers Without Borders use a Trimble® R2 GNSS receiver and Trimble CenterPoint® RTX to design water distribution systems in Rwanda.

Building the water distribution system was a community event, with locals helping to construct the system and students with Engineers Without Borders ensuring the design followed specifications.

Without Borders, a nonprofit organization that delivers sustainable engineering solutions to developing countries. Brodbeck is an engineer in the Biosystems Engineering Department at Auburn University, which formed a EWB chapter in 2014. It's grown to 200 student members and six faculty advisors.

Brodbeck got involved in EWB when several engineering students contacted him for help with processing GPS data from one of the assessment trips. EWB attracts students from all facets of engineering—including aerospace, mechanical and civil—and though few know geospatial technology, they learn it as part of their projects.

For the 2017 implementation trip, Brodbeck helped the students by providing technical support in the geospatial arena. During this implementation trip, Auburn University students built a spring box and pipeline to catch water from a groundwater spring and pipe it to the Kabaya Technical Secondary School (KTSS) in Rwanda for cooking and drinking. The engineering students designed the distribution system in Alabama before arriving in Rwanda. The KTSS project was successful, with work finishing ahead of the deadline, allowing the team to conduct assessment in neighboring communities for a possible 2018 implementation trip.

Brodbeck realized the team needed high accuracy for these projects so he contacted the university's Trimble distributor, Navigation Electronics, Inc. (NEI), who recommended the Trimble R2 and CenterPoint RTX. "They said the Trimble R2 and CenterPoint RTX would be perfect for the work and would have the accuracy we need," he noted.

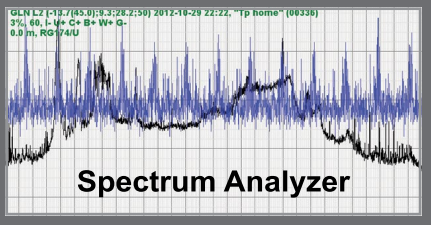
The Project Begins

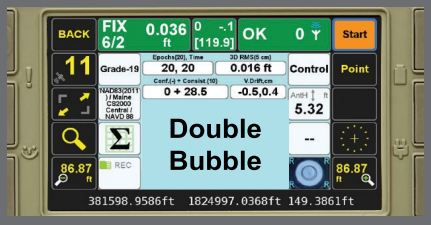
By now Brodbeck had accepted the role of Responsible Engineer in Charge and became the lead advisor to the Rwanda team. "I loved the work," he said.

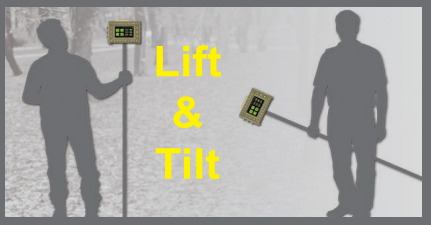
During the 2017 implementation trip, Brodbeck trained the team to use the R2 to generate an as-built map of the water distribution system. The team also performed an assessment for future projects and discovered Mwendo, a nearby community of 3,000 living at 8,000 feet above sea level. To access water, residents had to walk 30 to 45 minutes carrying 20-liter jerry cans. "The

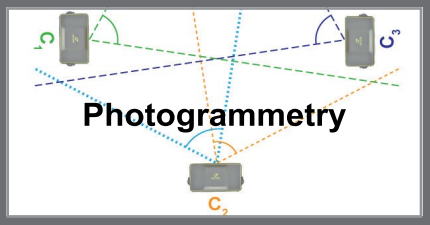
JAVAD Total Solution

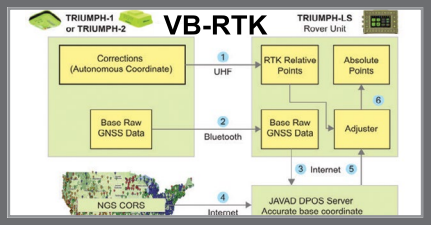
From 0 to ∞

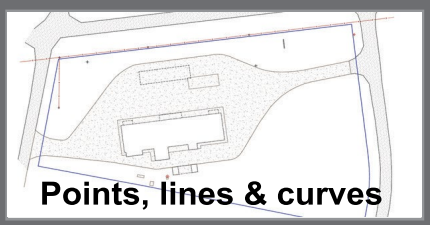


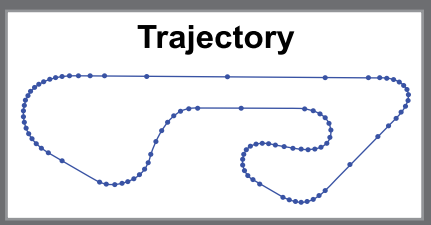












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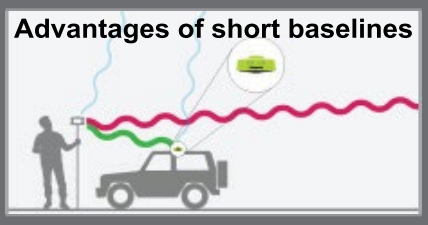


RAMS
Remote Assistance & Monitoring Services

For all others see www.javad.com

Front

The TRIUMPH-LS and its field software, J-Field,

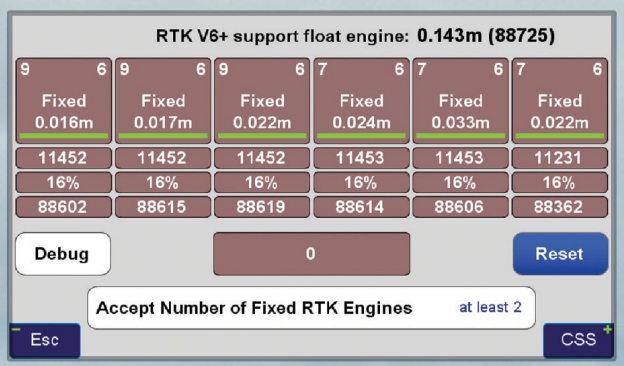
have many revolutionary and innovative features as compared to current GNSS systems:

- The TRIUMPH-LS contains everything needed to function as a **complete RTK rover** in one small, compact, ergonomic and very portable unit: an **864 channel GNSS receiver, a UHF or spread spectrum radio, a GSM modem, a Wi-Fi adapter, two internal cameras, a flashlight, and a bright 800x480 pixel display.** Included with the system is a collapsible monopod rover pole which allows the unit to be quickly folded up to fit in a very small space, **perfect for carrying the system through the woods** or quickly stowing inside a vehicle. The lack of a data collected bracketed to the rover pole increases further increases its portability and the user can **carry the system through the woods** without having to worry about a data collector bracketed to the rover pole getting caught in brush.

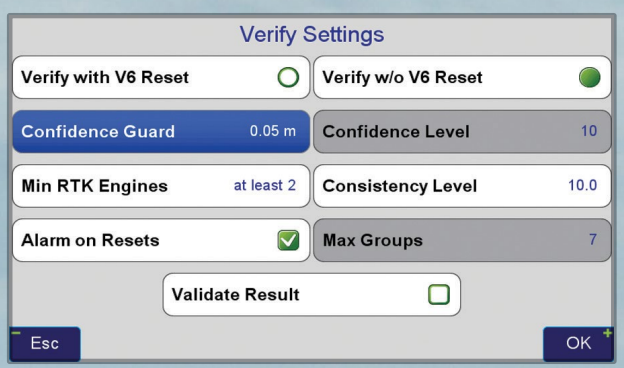
- This system was ergonomically engineered; the head height vertical display allows the user to operate the TRIUMPH-LS while standing in an upright position and looking forward. The user does not need to bend their neck to look down to view the display as is traditionally done with a system having a data collector attached to a rover pole. This feature allows the system to be used **without the neck soreness** that can plague a user bending their head downward to view a data collector for extended periods of time.

FL

• The field software, J-Field, is included **at no extra charge** with the system. There is no need for an external data collector or software. J-Field is constantly being improved and updates will always be available free of charge with the system. The updates can be **downloaded through Wi-Fi** and are very simple to install, requiring only a couple button presses to update the system.



• J-Field, features **6 separate parallel RTK engines** that all run simultaneously with separate assumptions. This allows for fixes to be obtained quicker than if only a single RTK engine was used.



• It has an advanced **RTK verification system** that can be used in difficult RTK environments where there is high multipath and/or tree canopy cover. This process will automatically reset the RTK engines and eliminate points from being collected with bad RTK fixes that often plague other systems in difficult locations.

• J-Field has many **customization** features that can be used to increase productivity as your knowledge of the system grows. The stake and collect screens have **10 white boxes** that are easily customized to display a number of fields which the user may desire.

Scan me and wach full video

FR

LIVE at www.javad.com

G’day, Mate!

Redefining Total Stations and GNSS workflow.

The “Total Solution”

From the company who brought you the best GNSS receiver on the planet, our latest innovation will allow you to break away from decades-old methods of measurement and positioning. Why employ a workflow designed for yesterday’s gear?

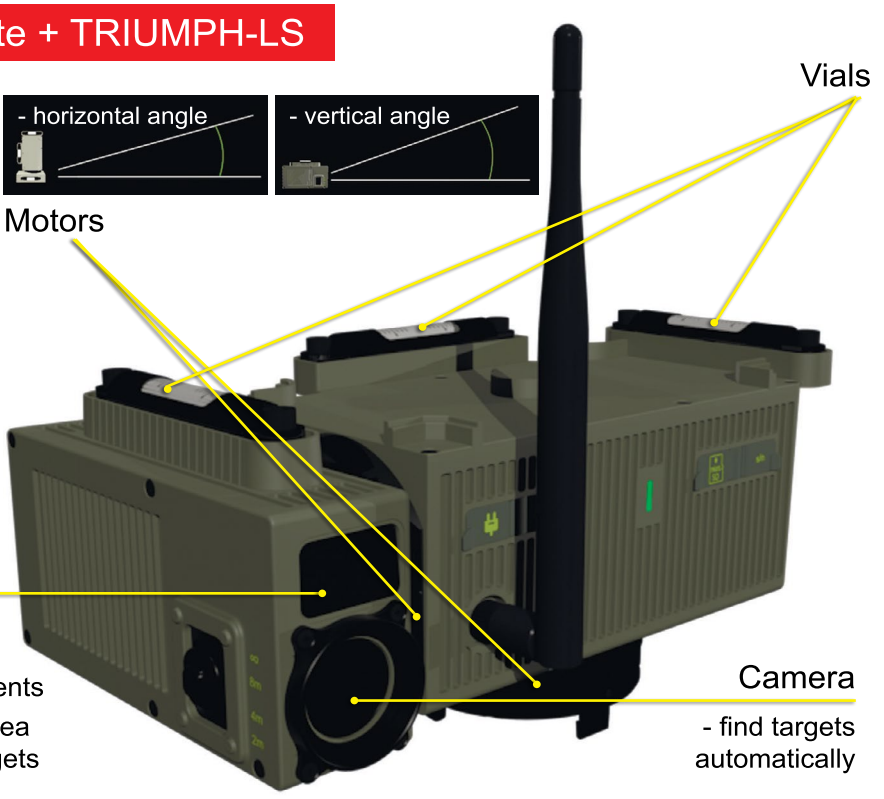
See the video at www.javad.com for proof!

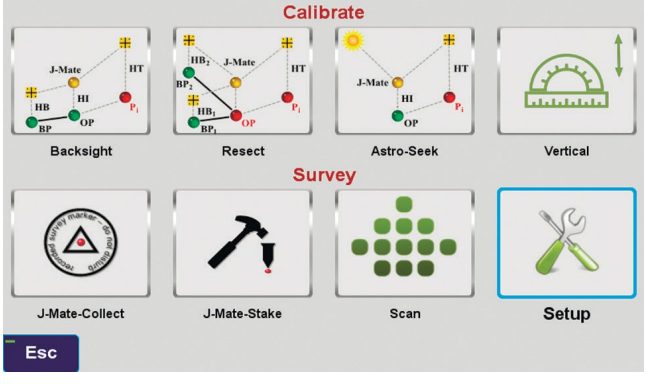
This is J-Mate

J-Mate features a **camera** that can also find targets automatically, and a **laser module** for accurate distance measurements. It scans and examines the area around the intended target to ensure reliable identification. Two **precision encoders** measure vertical and horizontal angles to the target. Three **precision vials** allow a visual check on levelness of the instrument.

Take control with J-Mate + TRIUMPH-LS

Similar to using conventional total stations, to use the J-Mate you need first to establish its accurate position and calibrate its vertical and horizontal encoders. Then proceed to shoot the unknown points. This is similar to using any total station, but we have improved and automated the process.





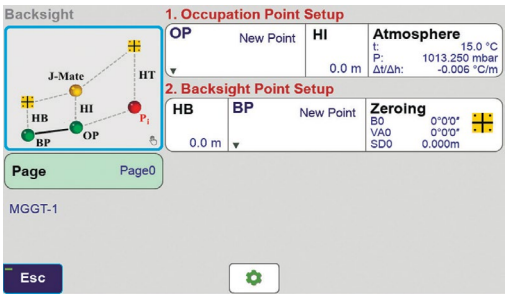
With J-Mate you can establish your occupied position via three different ways: 1) Backsight; 2) Resection; or 3) our new Astro-Seek (more of that later).

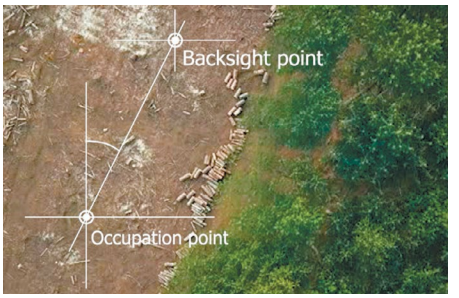
When you click the Setup icon of the J-Mate screen you get access to parameters that tunes J-Mate to your desire.

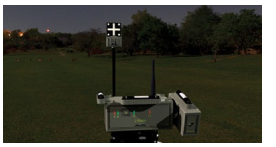
After the J-Mate is calibrated, you can proceed with your work as normal via the Collect or Stake icon.

Backsight icon

If GNSS signals are available at the job site, click the J-Mate Backsight icon.



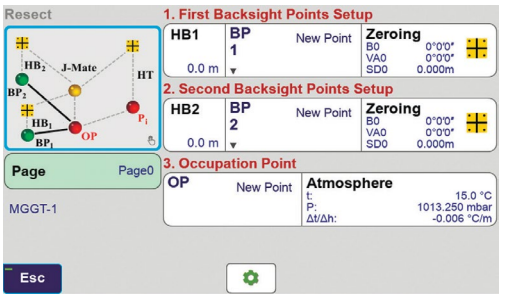


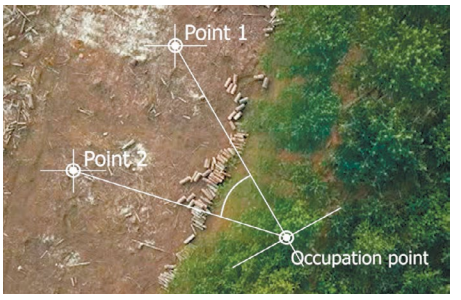


This screen appears which guides you to determine the accurate positions of the Occupation Point and the Backsight Point, to establish an azimuth and calibrate the J-Mate angular encoders.

Resect icon

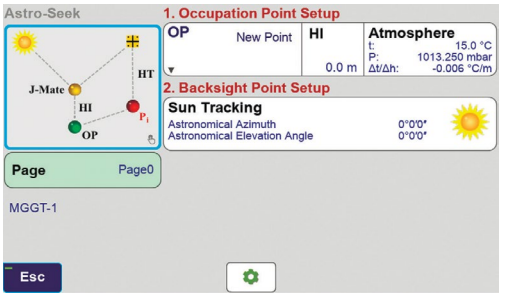
If GNSS signals are not available at the Occupation Point, click the “J-Mate-Resect” icon





Shoot two or more known points to establish an accurate position and calibrate the encoders. Then continue to shoot the unknown points.

Astro-Seek icon

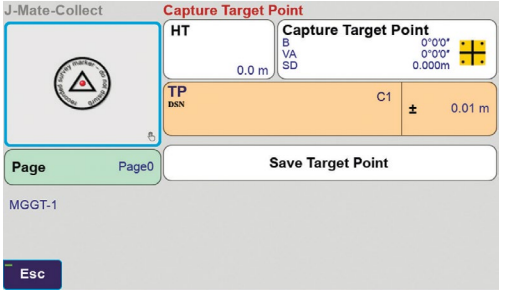


And now our new feature!

We have added a new innovative feature to the J-Mate that it can automatically calibrate itself via its automatic Sun or other astronomical objects-Seeking feature.

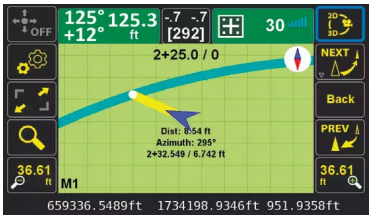
J-Mate-Collect

After calibration is performed, click the J-Mate-Collect icon to shoot the unknown points.



J-Mate-Stake

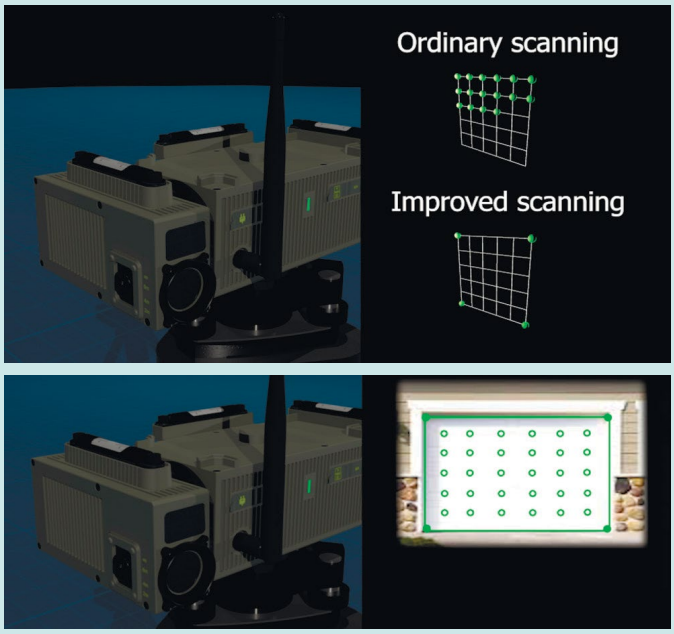
Click the J-Mate-Stake icon to use for stakeout.



The functions and features of the J-Mate stakeout are very similar to our conventional GNSS stakeout: RTK solutions guide you to the stake points. But with the J-Mate the camera follows the “+” sign that you carry and then the encoders and laser measurements (shown on screenshots) provide guidance to the stakeout features. This is similar to Visual Stakeout and other useful and innovative features of our TRIUMPH-LS GNSS RTK stakeout.

Smart laser scanner

J-Mate is also a camera-aided, smart laser scanner. The camera identifies redundant points that do not need to be scanned, but instead can be copied or interpolated from other readings without loss of information. That is, if the camera identifies a completely uniform flat area, it only scans the four corners of that area and interpolates in between. This feature can increase the effective speed of the scanner to much higher than its native 10-points-per-second speed.



The scanning feature can also be used to find items like wires and poles and "closest-in-view" items and shoot them automatically.

Seize the day with J-Mate + TRIUMPH-LS

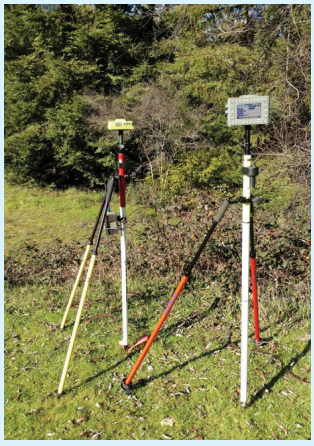
So we have a "**Total GNSS**" with a "**Robotic Total Station**" and a "**Smart Laser Scanner**". We call it our **"Total Solution"** and it can be operated by one person to perform jobs.

TRIUMPH-LS vs. R-10

Stephen K. Drake, PLS, CFedS

Scan to read details of competition >

JAVAD TRIUMPH-LS rover, TRIUMPH-2 base, with spread spectrum radio, and a set of pods I have hiked up mountains all over the country, even at a 115 degrees in the desert, thankful the whole set weighs less than my R8 tripod.



Trimble R-10 rover, TSC3 controller, and R-8 base, with its bonus (heavy) tripod. (yea I want to hike that up the mountain for my setup…) The market heavy weights! (yea pun intended).

Where Have You Been With Your TRIUMPH-LS Lately

"Btw, pardon my French, but holy shit. I got some ridiculous 'fixes' today in some horrible situations. Reset receiver, moved around, etc. Tried to get a bad fix but had a hard time doing it."

"Truly amazing with a 4" grape vine directly overhead and the tree cover."

"Got some shots that he could not get with our gr5's."

"This thing is bad ass!"

"I often get 2 days of work done, in a day."

"I got some ridiculous 'fixes' today in some horrible situations. Reset receiver, moved around, etc. Tried to get a bad fix but had a hard time doing it."

water flowrate was very low and the community did not have any storage capacity," Brodbeck said. "The plan was to rehabilitate a 10,000-liter tank, utilize it for water storage and install a pipe directly to the Mwendo Primary School for drinking water."

The location of the proposed pipeline was mapped as a line feature using Trimble TerraSync software. Using Trimble Pathfinder Office software, Brodbeck exported the line data as positions only, with one point per GNSS position, allowing the line feature to be exported as points with *x*, *y* and *z* attributes. Exporting the data in this manner allowed it to be opened with Microsoft Excel to create a table that displayed each point's actual elevation and its relative distance from the start of the pipeline. "We used this data to model water flow to ensure the water would be distributed as we had designed it," he said. Along the pipeline they mapped areas of interest, such as elevations at certain crossings and locations of potential springs.

The location of the pipeline had first been mapped as a line feature using Trimble TerraSync software. Using Trimble Pathfinder Office software, Brodbeck exported the line data as positions only, with one point per GNSS position, allowing the line feature to be exported as points with x, y and z attributes.

Before the distribution system was built, residents of Mwendo had to walk 30 to 45 minutes carrying 20-liter jerry cans to access water.

"This all worked extremely well," Brodbeck noted. "The data collected with the R2 was the backbone of the design the students conducted over the next few months. Trimble CenterPoint RTX provided reliable data when we needed to know the data is accurate and everything works correctly. Without this accuracy, our design would have been incredibly difficult.

"The Trimble R2 with CenterPoint RTX allowed us to collect 4-cm accurate elevation data, which we fed into a Storm Water Management Model (SWMM) model

Only a few students working on the water distribution system had geospatial experience, but the equipment, like the R2, was easy to set up and operate, and the students picked it up quickly.

to determine flow distribution under a variety of conditions," Brodbeck added. The team planned to return in August 2018 and needed accurate data to ensure the design would work.

New Challenges

But when the team went back to Rwanda in August 2018, there were some unexpected challenges. Work on digging the trench for the new pipeline started before the team arrived in Rwanda, and the trench did *not* follow the path the students had laid out. "This was a big deal because the trench that was dug required water to flow uphill, which as we all know, generally does *not* work very well," Brodbeck said.

But using the GPS equipment the team verified that the path was incorrect and that the location identified in 2017 would still work. "We used the R2 to verify elevations at five high-points along the pipeline, ensuring elevations were lower than the source point. The individual points were viewed on the Map screen of Trimble TerraSync so that we could view the elevation. Later, we would download this using Pathfinder Office and export it as an Esri Shapefile to view the data in ArcGIS."

The second hiccup was that the community had decided they wanted water in a third location, which the team had not planned. It meant an additional 600 meters of pipe and re-running the scenario with a computer model to check water flows. They worked late nights to complete the addition. Once assured everything would work, the team looked at funding. Thankfully, the team had budgeted contingency funds, which covered the additional expenses.

"We were able to accommodate the desires of the community, with the biggest challenge being trying to grow the project by 50 percent without going over budget," Brodbeck said. "We were able to accomplish this and the team was very proud."

Elevation Issues

Not surprisingly, working with the elevation change proved difficult. "For the first 300 meters of the pipeline, we only had about three meters of elevation change. After that, the terrain started to drop off so the elevation was not as critical," Brodbeck said. "However, within those first 300 meters we had to ensure that all points were lower than the start because we were implementing a gravity-fed system. Given that the terrain was very difficult, following traditional survey techniques or using an auto-level would have been incredibly challenging."

The R2 was used extensively for assessment for future work, Brodbeck said. Much of the data collected was similar to what was collected in 2017. The team mapped locations of springs already tapped and their pipelines. When meeting with community leaders, they visited untapped springs to map them as well as the possible water tap locations.

"All this data would be downloaded with Pathfinder Office and exported as SHP files to ArcGIS. Within ArcGIS, we could look at the data and start to make plans for next year. We also used the R2 to map and create an as-built map of everything we built during our current project."

Only a few students had geospatial experience, but the equipment, like the R2, was

Brodbeck didn't need a full-range pole, which splits in half, so he took one half and put it on a pipe for balance and then screwed in the R2 so he didn't have the weight of a full pole for traveling.

The community wanted water in a third location, which the team had not planned. It meant an additional 600 meters of pipe and re-running the scenario with a computer model to check water flows. They met the request and still stayed within budget.

easy to set up and operate, and the students picked it up quickly. Brodbeck has been using Trimble equipment for more than two decades. "We got a few pointers on using CenterPoint RTX, to help with adjustments, but it was very easy to operate."

The team used local workers for much of the construction, hiring 94 day laborers to dig the 1,600-meter trench and two skilled laborers—a mason and a plumber—for much of the installation. "By hiring local workers, we were able to provide them with daily wages in an area where finding work is nearly impossible."

Long Days

The EWB team put in long days. Lodged at a Catholic Church Parish, they started their day with breakfast at 7 a.m. before piling into Land Cruisers for a rough 45-minute drive to Mwendo, where the work was taking place. At 9 a.m. everyone gathered in a small building that served as EWB headquarters and each person would grab their tools and set off to work on their daily task.

"We would spend the morning working in our respective areas, then gather at 1 p.m. for lunch at EWB Headquarters," Brodbeck said. After lunch they continued to work until it got dark around 6:30 p.m., when everyone met back at headquarters, stored their tools and drove back to the Parish. After dinner, they would review the day's progress by looking at the GPS data gathered, doing some analysis on how things were progressing, reviewing and updating the budget, and laying out a work plan for each team member for the following day. In addition to the engineering work, they collected water samples, incubating them to determine if the water was safe to drink.

Part of the evening review also included identifying areas needing work. Usually there were two students supervising the pipe installation, two working with the mason to ensure the boxes he was building were to spec and two students doing assessment. "We would rotate job assignments daily so everyone had an opportunity to see and help with different parts of the project," Brodbeck said. "We would wrap up around 11 p.m., by which time we were all quite exhausted."

Future Plans

The team plans to return in summer 2019. Once post-trip reports are complete, they will determine the next project.

Brodbeck says the students deserve the real credit for the Rwanda success. Not only do they perform all data collection and then work countless hours on the design, they also spend much of the year fundraising because the work is conducted using donations. In addition, the work is extracurricular, so they don't receive school credit for it. They design the projects on their own time, and implement them on school breaks between semesters. But the work is also rewarding. Each project allows the students to learn engineering skills and geospatial technologies while helping to make the world a better place. ■

Kristine Carber-White is a writer based in Silicon Valley. A former editor for the San Jose Mercury News, White writes extensively on geospatial technology.

The 2018 EWB travel team consisted of Stephanie Parson (Team Lead), Beth Prior, Zach Johnson, Katelyn Jenkins, Caleb Daniels, Andy Bowling, Morgan Bell (Advisor) and Christian Brodbeck (Advisor).

This illustration shows the land owned by David Camp at the time of his death in 1838, including an ivy covered horse stable.

ILLUSTRATION BY TARA HANNON.

Ohio's Westward Expansion

Recognizing the work of an early pioneer, county surveyor

As Sandusky County prepares to celebrate its bicentennial, it seems appropriate to reflect on the work of pioneering county surveyors, those who came after federal government surveyors were done "laying out the land" of the Public Land Survey System and after Ohio became a state in 1803. This article focuses on the contribution of David Camp and how his work was essential to the growth and development of northwest Ohio, specifically Sandusky County.

The office of county surveyor was established by the first Ohio General Assembly. When a new county was created, the Common Pleas court appointed public offices, including that of the county surveyor. These appointed positions were reserved for the educated class. At the time, the duties of the county surveyor were to verify land titles and boundaries, and to establish state, county, and township roads. The Ohio State Legislature made the office of County Surveyor an elected position in 1831. The newly elected surveyor would serve a term of three years, "if he so long behaved well and until his successor is elected and qualified."

Sandusky became a County in 1820. Ezra Williams was the first appointed County Surveyor followed by David Camp who served from 1828–1936. Camp being the only person who was first appointed and subsequently elected into this position.

David Camp was born on January 2, 1778, in Litchfield, Connecticut. He married Elizabeth Root in 1803 in Chittenden, Vermont. Together they started a family in Westford, Vermont. In 1814 the family moved to Minisink, NY. They remained there until 1822 when the Camps packed up all their belongings in teams of Oxen and headed westward to Sandusky County, Ohio. At this time Sandusky was a dark, thick overgrown forest and marshland known as the Black Swamp. The land was soaked in water, filled with wild animals and Native Americans with few good roads for travel.

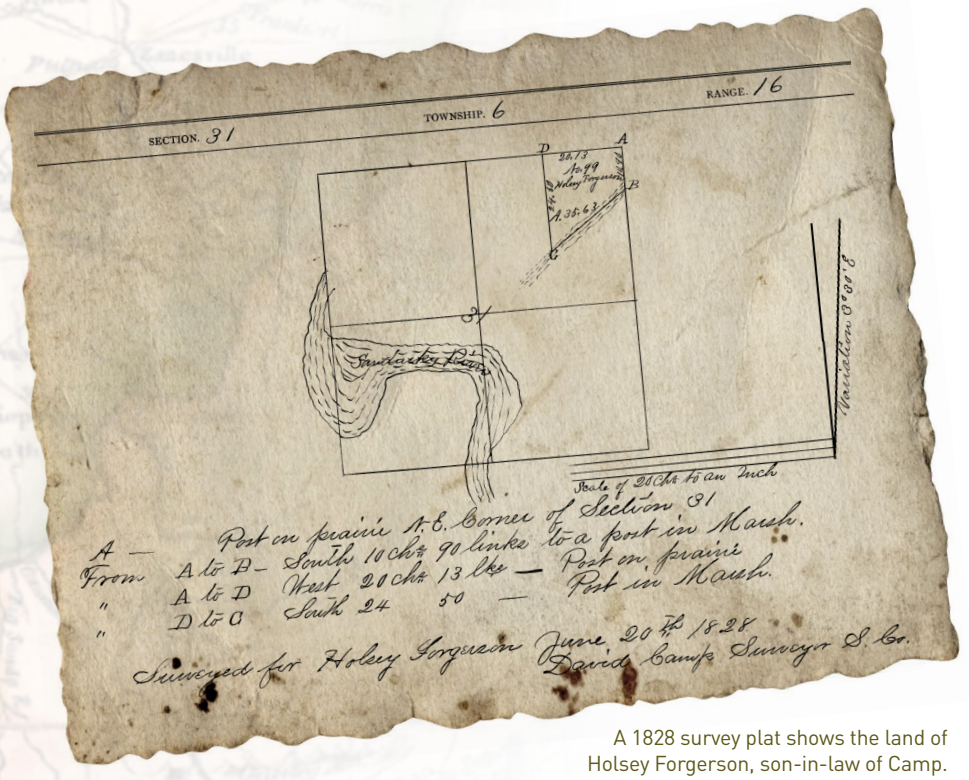
In 1830 President Jackson signed the Indian Removal Act, which opened up even more land for new settlers by displacing several active Indian tribes in northwest Ohio. Pioneers making the westward trek needed good roads to travel. I am reminded of the movie *Field of Dreams* when the Iowa corn farmer hears a voice telling him, "If you build it, they will come." So it was with the roads in Sandusky County. Camp laid out new state, county and township roads making it possible for settlers to head west and easier for farmers to bring their crops to the market.

Little pieces of Camps work is buried and scattered, like bread crumbs, across Sandusky, Huron and Wood Counties. Digging through old county records, one can find Camp's field notes, plats, and county commissioner journals from the 1820-1830's, including references to physical features on the ground that are still here today. These

» SHERRI LEE BARNES

This 1859 photo of the Sandusky Lighthouse (now known as Marblehead Lighthouse) shows the stone house as described in Camps 1834 field notes. A commemorative brick honoring David Camp lies on the Marblehead Lighthouse pathway.

PHOTO COURTESY OF MARBLEHEAD LIGHTHOUSE HISTORICAL SOCIETY.



A 1828 survey plat shows the land of Holsey Forgerson, son-in-law of Camp.

glimpses of the past are evidence of Camp's contribution to the growth and development of not only Sandusky County but also to Northwest Ohio.

Camp surveyed the state road from Lower Sandusky (modern day Fremont) to Findlay in 1830, as well as the Findlay to Port Clinton state road in 1831. Field notes from a 15-day survey in 1832 describe a 66-mile long public road being established from Fremont to the former Fort Defiance, which was being used as a trading post. Also, in the commissioner records are roads from Fremont to Perrysburg, home of Fort Meigs, which has been reconstructed and open to the public. Another road runs south from Fremont to Fort Seneca, a supply depot during the War of 1812. All three of these forts were used in some capacity during the War of 1812.

A portion of Port Clinton Road, Muddy Creek, and a bridge appear on a survey plat in 1832 when Camp surveyed Section 30, Township 6 North, Range 16 East, Ohio 1st PM, into lots for Isaac Lathrop and Holsey

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Forgerson. All three features still exist. This example is one of many survey plats on file at the Sandusky County Surveyor's Office that breaks down sections into lots for pioneers.

A 60-foot wide wide state highway that crossed three counties from Marblehead Lighthouse, on Lake Erie, goes westerly to the Maumee River. Marblehead Lighthouse was built in 1821 with an adjacent stone house for the lighthouse keeper. "Beginning at a post 50 links S.E. of the South Corner of the Stone House by the lighthouse on Rocky Point, thence by the magnetic needle," states Camp's field notes, which continue on to describe the 45-mile survey and ends "to a post on the East bank of the Maumee River, opposite the mouth of Swan Creek." Since then, the stone house has been replaced with a new house built in 1880, and an additional 15 feet was added to the lighthouse. The lighthouse was featured on a US postage stamp in 1995, and is the

Camps journals have been preserved and show records of his agricultural operations. This page is dated 1838.

PHOTO COURTESY OF SCOTT GOULD, 3X GREAT-GRANDSON OF DAVID CAMP.

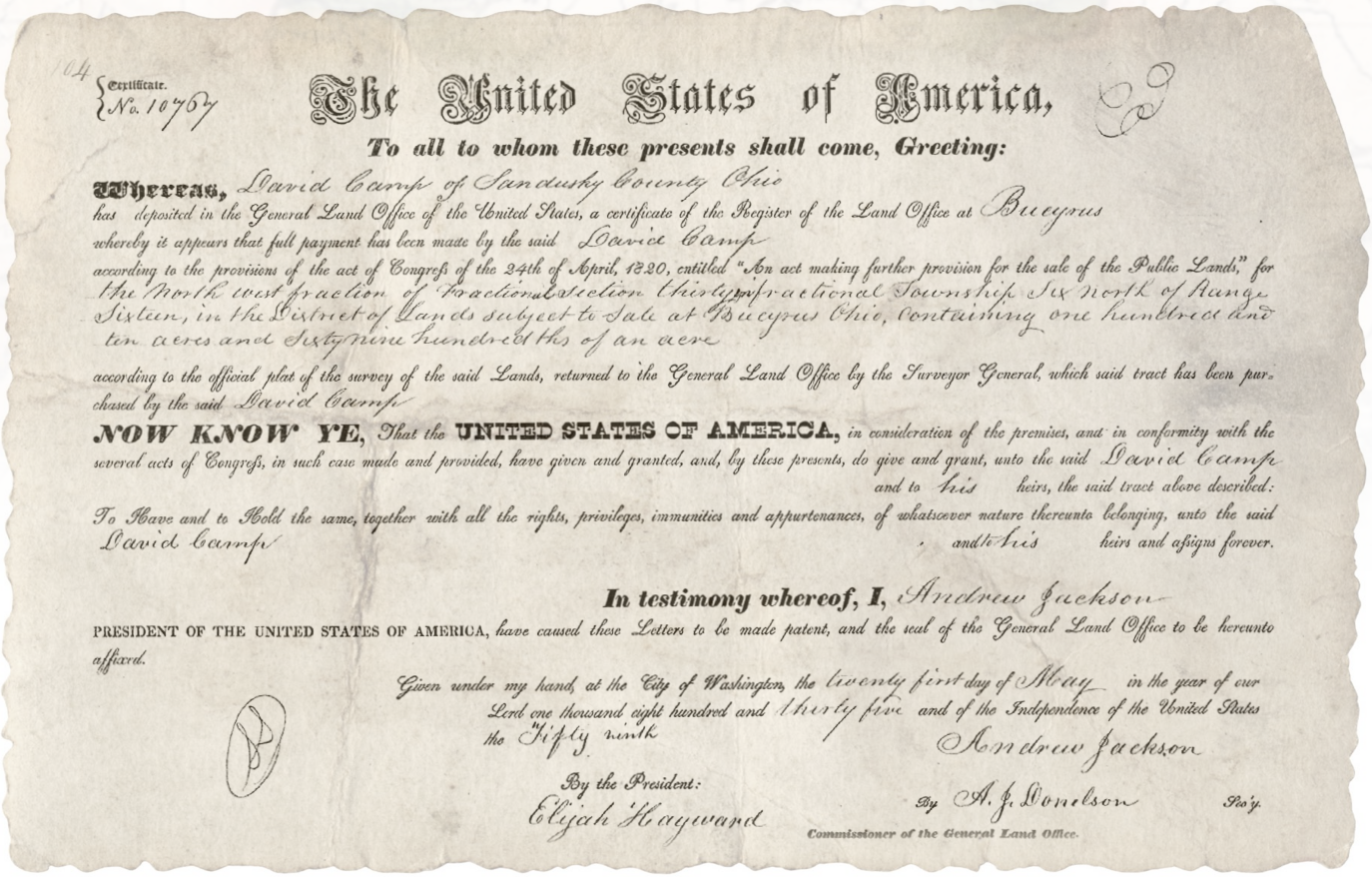
A portion of the Whitaker Reserve was surveyed by Camp in 1836. The original found on EBAY in 2016 and purchased by Sherri Barnes.

oldest lighthouse on the Great Lakes in continuous operation to this day. In 2017 a visitor to the lighthouse donated a photo, dated 1859, to the Marblehead

Lighthouse Historical Society. That photo shows the original stone house as described in Camp's field notes. Working on Camp's survey crew was Albert Camp (son of David Camp), Edward J. Lockwood (son of Sam Lockwood), Fulton Henderson, J. Kirpe and J. Philips.

In 1835 Camp laid out village lots on the east side of Bellevue, Ohio, creating the first village plat of the town. According to an article about the Western Reserve, early village lots were priced low with longer time periods to pay off the debt to entice people to move to the area. Today, most of the layout of Camp's survey is still there. The public square is gone, but the roads that remain, including Main Street; appear to be the same width as originally drawn.

Another interesting survey plat shows a portion of the Whitaker Reserve. This original survey was found, of all places, on eBay. It is dated August 22, 1836. The survey shows the Sandusky River and the south-west corner of Whitaker Reserve. James Whittaker and his wife, Elizabeth Fulks, were both prisoners of the Wyandot Indian Tribe in Northwest Ohio. They were given 1280 acres of land which came to be known as the Whittaker Reserve. The Whittaker



Certificate.
No. 10767

The United States of America,

To all to whom these presents shall come, Greeting:

Whereas, David Camp of Sandusky County Ohio has deposited in the General Land Office of the United States, a certificate of the Register of the Land Office at Bucyrus whereby it appears that full payment has been made by the said David Camp according to the provisions of the act of Congress of the 24th of April, 1820, entitled "An act making further provision for the sale of the Public Lands," for the North west fraction of fractional section thirty, fractional Township Six north of Range Sixteen, in the District of Lands subject to Sale at Bucyrus Ohio, Containing one hundred and ten acres and Sixty nine hundredths of an acre

according to the official plat of the survey of the said Lands, returned to the General Land Office by the Surveyor General, which said tract has been purchased by the said David Camp

NOW KNOW YE, That the **UNITED STATES OF AMERICA,** in consideration of the premises, and in conformity with the several acts of Congress, in such case made and provided, have given and granted, and, by these presents, do give and grant, unto the said David Camp and to his heirs, the said tract above described:

To Have and to Hold the same, together with all the rights, privileges, immunities and appurtenances, of whatsoever nature thereunto belonging, unto the said David Camp and to his heirs and assigns forever.

In testimony whereof, I, Andrew Jackson

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 twenty first day of May in the year of our Lord one thousand eight hundred and thirty five and of the Independence of the United States the fifty ninth

Andrew Jackson

By the President:
Elijah Hayward

By A. J. Donelson Sec'y.

Commissioner of the General Land Office.

David Camp land patent dated 1835. Land patents like this one can be found online at: http:/glorecords.blm.gov

Reserve was part of the Treaty of Fort Meigs in 1817 and was deeded to the family by President James Monroe in 1823. Camp was paid $24.00 for this survey. Family legend indicates Camp's wife, Elizabeth, drafted the survey plats from her husband's field notes.

Unlike modern-day county surveyors, Camp did not receive a monthly salary. Public records and his journals show his pay for a day of surveying was $1.50. He was paid $27.00 for 18 days of work for the Marblehead Lighthouse survey in 1834. Survey crew members and viewers each earned $0.50–0.75 per day. In the 1830's surveyors were only paid for work performed. When there was no county business to attend to, Camp took care of his family, crops, and farm.

Camp, like many of us today, teamed up with another surveyor to do additional surveying work. He and Sam Lockwood joined forces and created "Lockwood & Camp." Lockwood was a well-known surveyor in neighboring Ottawa County. Camp kept records of business in his journals. In March 15, 1835 they paid Albert Camp (son of David Camp) for 6 days of survey work and for making a trip to file a survey at the General Land Office in Bucyrus, Ohio.

Sandusky County Commissioner records describe Camps field notes and plats. One such example requesting a road survey reads as follows:" The inhabitants of the County Township petition the Commissioners and pray for a county road to establish commerce on the county line between Huron & Sandusky" The roadway would be surveyed and then read publicly in an open meeting with the commissioners.

In addition to his county surveyor position, Camp held other public offices including that of county commissioner, assessor, and from time to time he stood in as justice of the peace. He served with more famous Sandusky County pioneers such as Israel Harrington and Jesse Olmsted. In 1833 he helped establish the local Presbyterian Church and served as one of the first elders. He was also part of the Whig Party and attended the Whig Party Convention at Fort Seneca in 1836.

The Camp's endured all the hardships and trials that come to early settlers. They participated actively to ensure that growth progressed. At the time of his death in 1838, Camp owned five parcels of land totaling a little over 172 acres, including an ivy-covered horse stable that once stood at the corners of County Road 145 and North State Route 53 in Fremont, Ohio. After his death, his survey crew helped Mrs. Camp finish his work, drafting plats from his field notes. He is buried at Whittlesey Cemetery in downtown Fremont, Ohio. His headstone lies in a pile, along with that of other pioneer headstones.

David Camp left his mark on Ohio where glimpses of his work can be seen today, almost 200 years later. The work of those early pioneering surveyors, whose names are all but forgotten, was essential to the growth and development of Ohio. Andro Linklater, the author of the book *Measuring America,* once asked, *"Which came first, the pioneers or the surveyors?"* Luckily, for Northwest Ohio; David Camp was both. ■

Sherri Lee Barnes has worked in the surveying industry for over 33 years. She last appeared in the January 2017 issue where she wrote about the history of surveying the Colorado River Aqueduct. She is the 4x's great-granddaughter of David Camp.

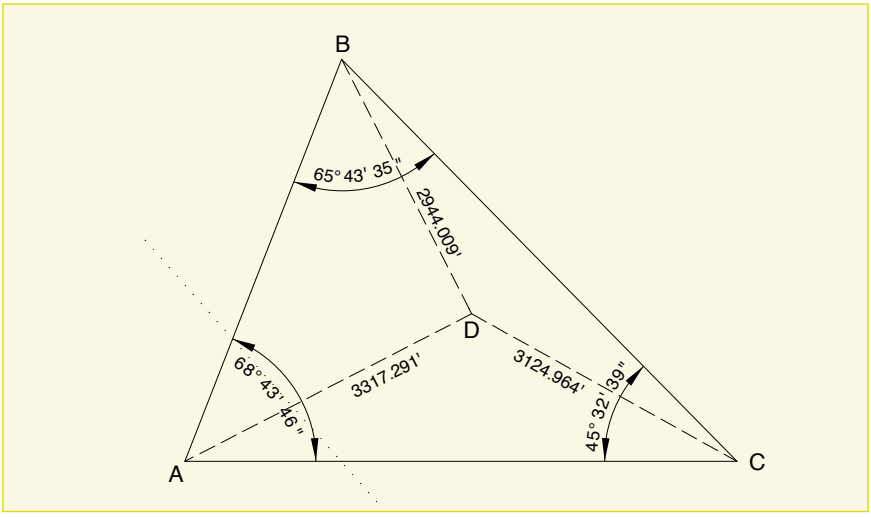
test yourself

Inside Out

With the given interior angles of triangle ABC and the distances from point D to the vertices, what are the lengths of the sides of the triangle? ■

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*.



Thought Leader, *continued from page 2*

appropriate surface geophysical methods to determine the existence and approximate horizontal position of subsurface utilities.

Needless to say, the engineering community in Colorado has concerns about being held responsible for utility information depicted in engineering drawings, because it is typically not something they would be gathering themselves. Although one could argue that design plans are routinely produced using information produced or gathered by professional surveyors; the difference here is that the statute puts the burden of the locate request on the engineer which may have consequences relating to liability.

Table A, item 11 of the 2016 Minimum Standard Detailed Requirements for ALTA/NSPS Land Title Surveys essentially represents a Quality Level C investigation. The ALTA and NSPS committees will, during the next revision, consider whether ASCE C-I 38-02 Quality Level C should be specified as the performance standard for Table A item 11.

It is likely that Surveyors will begin to receive more requests to perform utility investigations to one of the ASCE quality levels, so they should familiarize themselves with ASCE C-I 38-02 and always be acutely aware of their responsibilities under state's utility damage prevention law.

Surveyors do not have x-ray vision, but they can mitigate potential liability and dangerous situations by knowing the law, the applicable standards and, most importantly, by clearly communicating what they know, what they do not know and what steps they took to locate and depict underground utility locations. ■

References

http://call811.com/best-practices/best-practices-guide/best-practices-manual

Colorado Revised Statutes 9-1.5-103

2016 Minimum Standard Detailed Requirements for ALTA/NSPS Land Title Surveys

Gary Kent is Director, Integrated Services at The Schneider Corporation in Indianapolis. He is past-president of ACSM and chairs the ALTA/ACSM Committee for NSPS and the Liaison Committee for ALTA. He is on the Indiana Board of Registration and lectures both locally and nationally.

feedback

Bloomberg Article

I enjoyed your article in the *American Surveyor* September 2018 issue. I think the Yale University employee's remarks are somewhat true. I would add there are two culprits suppressing the progress of the land surveying profession across America. These are the NCEES shadowing all state licensure boards and the Geographical Information Systems (ESRI) software in use in nearly all state government agencies involved with cadastral mapping and improvement valuation assessments.

Many years ago I, like many others, became very interested and excited about the ESRI software. As the years have gone by I see the inroads that it is making in regards to boundary surveying. Not good. I now use this quote quite often: "the memorization of software commands does not equal intellectual intelligence."

Due to these inroads made I now see that we are on the brink of the situation created by the England Ordnance Surveys noted in your book "The Curt Brown Chronicles" on pages 272, 370, and 388. I acquired your book as soon as it was advertised and want to congratulate you on a superb book. I can only imagine the wonderful relationship you had with Mr. Brown.

Back to the Yale university employee. As Dr. Hendricks would say, "they were educated beyond their level of intelligence." Mr. Frank Lloyd Wright is also noted with a similar quote.

Always on the alert for your articles when the *American Surveyor* magazine arrives in the mailbox.

Dwight Crutchfield, RLS
Tennessee

Professional Responsibility

Your October 2018 issue (your 150th, an impressive milestone) includes articles at the front and back that resonate with each other. Jason Foose's essay speaks to professional ethics, and quotes a definition of ethical behavior that goes beyond what is merely legal. Wendy Lathrop's report describes problems for lay people buying property when they don't understand what is on their survey, or worse, what isn't there but ought to be. Until I recently retired, I was general counsel to a financial firm where an important aspect of my job was to explain to the CEO the meanings and implications of the various provisions in legal documents, and to alert him to what was not included that we might need to have inserted. The CEO had the advantage of a legal adviser (me) who served as an insurance policy against future problems. Ordinary property purchasers ought to get the same sort of professional "insurance" from the surveyor who prepares a survey of the prospective purchase. For that to happen, the surveyor must place himself in the shoes of the buyer and imagine what might cause problems in the future, taking into account the buyer's plans for the property (to the extent the surveyor knows or can reasonably project them). As a professional service provider, the surveyor must "think like a property-owner" to anticipate trouble before it happens. It's not enough to "think like a surveyor," or even to "think like a lawyer." To be truly ethical, a surveyor must also go beyond what is legally required and must become a problem-solving seer. A tough assignment, but isn't that what separates ethically responsible professionals from mere skilled technicians?

Andrew Alpern

Got some feedback?

Contact us via *www.amerisurv.com,* or send a letter to: The American Surveyor, 7820-B Wormans Mill Road, #236 Frederick, MD 21701. We reserve the right to edit letters for clarity and length. ■

Lathrop, *continued from page 40*

acquire resilience when we find purpose in our work. We seek mastery—expertise, skills, commitment and recognition—in our domains. And we need autonomy—independence—in what we do."

But more contributes to burnout than just what happens during the work day, as I have learned painfully. As my mother's dementia deepened, her hoarding tendencies worsened, making it easier for her to lose things in the mess, thereby feeding into paranoia that someone was breaking in and stealing from her. This meant accelerating my efforts to declutter her apartment while continuing to wait for an opening in the memory care section of her retirement center.

For over a year, my part time job became weekly Saturday travels to her apartment to sneak out a full car load of 20-year old utility receipts from her former house amidst assorted loose papers, duplicate items she forgot she already had, hundreds of jars stacked inside of each other (in case she might need a specific size), formal dresses not worn in decades, and so much more. Every Sunday I sifted it all into "discard", "donate", "recycle", and "keep" piles, with multiple trips to Goodwill and Salvation Army to keep my garage from overflowing.

Losing a sense of control over my own life while trying to sort through hers pushed me toward burnout as the emotional and physical demands meant scant creative thinking time when handling my own usual workload and no personal downtime. I know that my experience is not unique. But it underscores the need for a holistic view of what causes burnout.

For physicians in the referenced article, burnout was attributed to "the overwhelming strains of bureaucracy and paperwork, the vast quantity of time spent at work and a lack of respect from administrators and employers" and a lack of adequate compensation. That translates well to our profession as well. ■

The article is posted on the New York Times website: *nytimes.com/2018/10/10/magazine/for-doctors-delving-deeper-as-a-way-to-avoid-burnout.html*

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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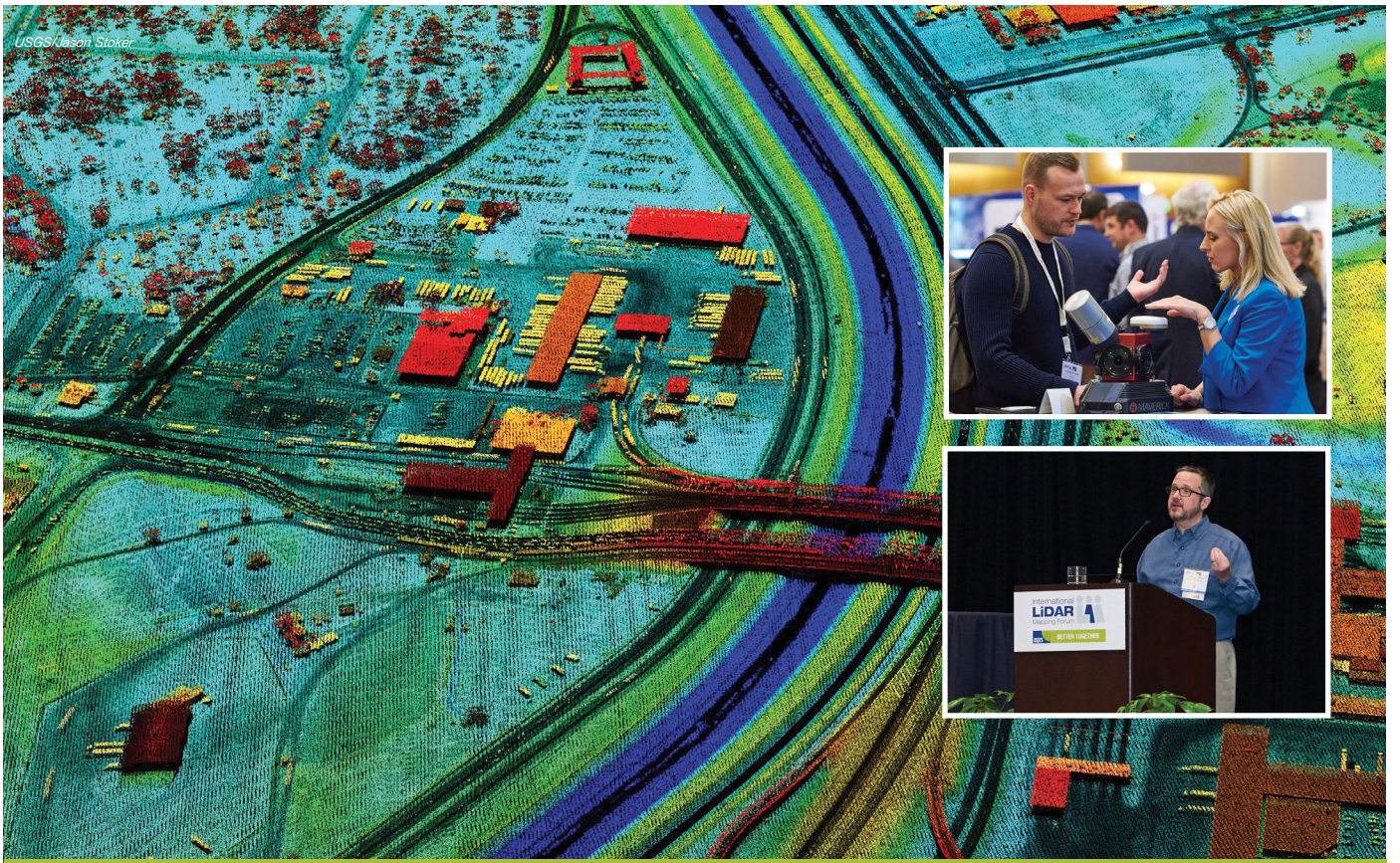

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Thoughts on a Resilient Career

As often happens, reading a recent article not about surveying made me think about surveying. It was a piece about medical students and practitioners facing burnout and changing careers as a result. The author, a medical researcher who also writes books and sees patients, reflected on the challenge of retention in a field where so much is invested both in terms of years and dollars. I shared the article with my own research physician husband, who also runs the MD-Ph.D. program at the University of Pennsylvania and worries about students not completing the seven-year program. The investment in such education, internship, and residency is high, and students dropping out before completion face the daunting prospect of losing all grants supporting them so that they depart with huge debts besides drained emotions and energies.

The problem of professional burnout is not unique to medicine. I have seen it in others and I have experienced it myself.

What makes us stumble in our profession? In the years I managed staff before turning to my own solo practice, the threat of their burnout was most acute when there was the least autonomy, the narrowest scope of work defined for a position, and/or the most pressure from heavy work schedules. For me as an employee, it was similar: frustration from not having a voice in how work could be best accomplished, boredom from seemingly endless repetition within a narrowly defined set of tasks, and unrelenting pressure from deadlines piled on top of deadlines by higher ups who didn't prioritize between themselves before each individually telling me their own project was "Priority Number One."

Helping others thwart burnout at work can be difficult, as declining productivity and enthusiasm have many causes. I found staff meetings helped to air some of the problems and eventually come up with some fixes. Some people were bored with the same kinds of work. Some felt unappreciated when finishing ahead of schedule and under budget. Others had no idea why they had to collect some of the data they were being asked for and resented what they thought was "busy work."

> "...the threat of... burnout was most acute when there was the least autonomy, the narrowest scope of work defined for a position, and/or the most pressure from heavy work schedules."

Some complaints are easier to resolve than others, depending upon support from those higher up the managerial ladder. Certainly personal acknowledgement of achievements should be a natural process. But assigning more responsibility with associated accountability means additional training for some, an investment of time and company resources in building stronger staff, whether through in-house training or by sending staff to night school. In another experiment, some field people swapped a week with office staff to see the other side of the picture. The cross-training ended up educating both the "insiders" and the "outsiders"—beyond finding out that it wasn't all cushy on the other side of the office door, no matter which side they had started on.

Back to the article that triggered this train of thought: The author reflects on various writings on the subject of resilience in the face of adversity and concludes that coming out alive and intact is related to a sense of purpose and meaning. "We

continued on page 38

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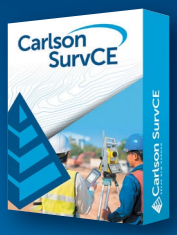

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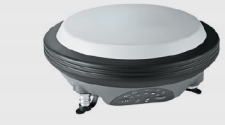

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