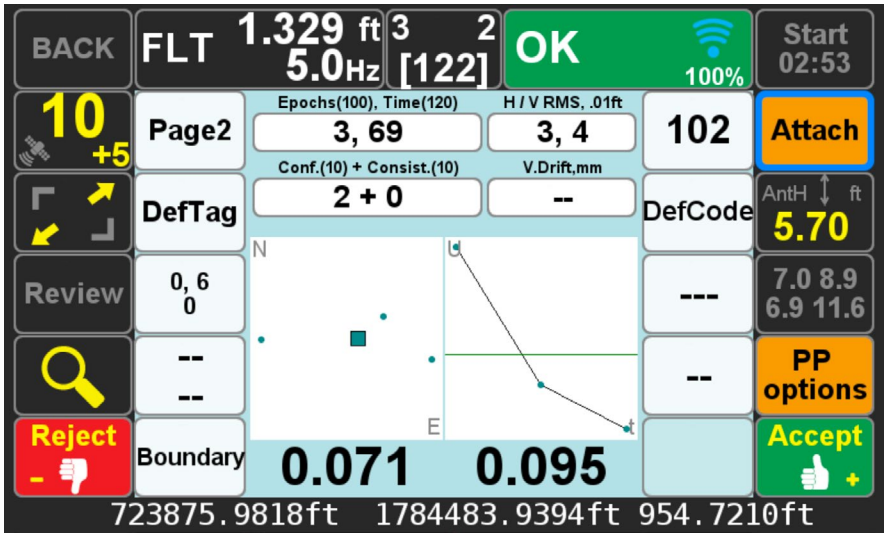
JAVAD Triumph-LS Rover

A Technical Review PART 2

In the last issue of *American Surveyor*, I looked at the background of JAVAD GNSS, the maker of the Triumph-LS, an RTK/RTN rover. That installment examined the design assumptions in this unique GNSS receiver and its impressive technical specifications. But all that technology means little if the software is not its equal. This second part analyzes the software and support provided by JAVAD, as well as some ancillary features of the system.



An example of the Collection screen. The screen has 10 white boxes—5 per side—that can be customized to show information such as distance from last point, type of RTK collection and attribution.

Software

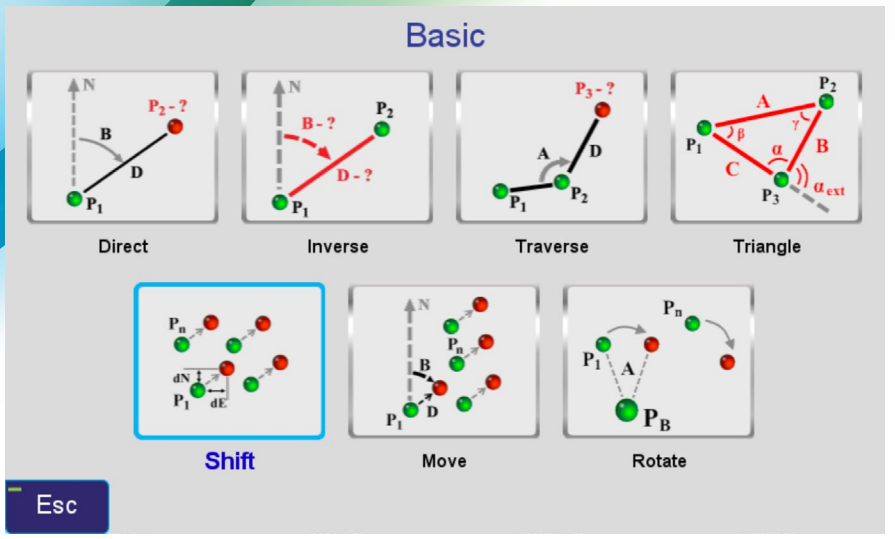
As I noted in the first part of this review, JAVAD's software (J-Field) is designed by and for land surveyors. But that wasn't the case when it was first released. Although the receiver was designed for surveyors, the initial software did not reflect the way that American surveyors work. JAVAD listened to user feedback and made a complete U-turn by reaching out to professional land surveyors all over the country for input.

The software is now in its fourth year of refinement and has been polished and tweaked repeatedly by working land surveyors. I was told that over the last four years, JAVAD has solicited and received feedback from well over 100 US surveyors. And as I noted in Part 1, its active support team is now comprised of five professional land surveyors who constantly request software enhancements.

As part of my research I systematically went through the dates of software releases, looking at the magnitude of the revisions. As I mentioned earlier, the many updates are rarely bug fixes; instead, they tend to be what other makers would call major releases. Like Apple, JAVAD does not discuss its pending revisions. But they have included COGO enhancements, a photogrammetry option and the integration of the rover with a unique metal detector (the J-Tip). The current OS for the JAVAD LS is Windows Compact 7, but there are plans to migrate to Linux, a more flexible system that will allow further innovations.

All of that said, the software is initially intimidating, although the underlying organization is quite elegant. There is a definite learning curve. I personally found that once a user visualizes the structure of the software, it makes complete sense.

» PATRICK C. GARNER, PS



Basic COGO functions. Each option has multiple sub-options.

This is a robust—even muscular—software that will pay endless dividends once it's mastered. But that mastery takes effort.

COGO

The COGO options that are built into the software include basic functions such as inversing, traversing, triangulations and point shifts. Other COGO options include offsets, intersections, staking (for instance, dividing lines, staking curves and 3-point arcs), and determining area by exterior perimeter and via hinging. These routines are all conventional and have little learning curve.

One extremely useful tool in this section is clustering. If, for instance, you need verified accuracy, clustering allows you to take multiple shots on a point, then select those multiple points and "cluster" them to determine a more accurate location. The clustering routine includes weighing the value of individual points, and may be used when a state requires certain positional tolerances. It works as an alternative to, or with, Least Squares.

Matt Sibole, a Kentucky PS, told me that for boundary work he routinely takes a minimum of three shots per corner, and then uses the clustering option to obtain highest accuracy. By the way, the LS creates PDF reports of each cluster operation for later review and/or proof of how the work was performed. It's a great option if your State Board or your client asks for precision verification.

Actions

JAVAD calls its rover point collection options Actions. These are really the core of the rover's operations. Pre-programmed actions include Boundary, Topo, Quick Topo, Staking and other field operations. Each action has appropriate programming based on a user's need for speed, accuracy or ease of collection.

Actions are one of the unique and most powerful attributes of the LS in that they are completely customizable. The user can modify parameters for accuracy, both horizontal and vertical, for number of epochs logged, for minimum times that the rover should record points, for tilt correction, for minimum number of engines, for verification and for other parameters. Surveyors can build their own actions for unique uses.

Almost all of the users I spoke to have developed their own actions for such things as offsets, wetland edge location (and similarly top bank of creeks), and for locating building corners. The actions can be modified on the fly, so that a surveyor can tweak a custom action to respond to an unanticipated situation.

Camera Functions

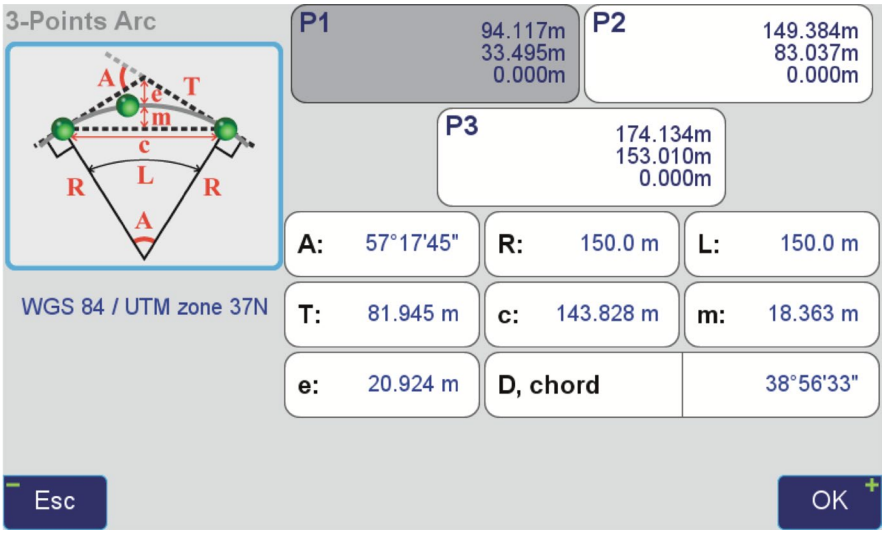
The two built-in cameras in the rover also have their own routines. After calibrating the horizontally-directed camera, the LS can determine angles between points to a10-minute accuracy. It will also allow you to locate points or objects by offset, a useful tool for picking up encroachments or improvements that may be physically inaccessible. The downward directed camera is useful for documenting the appearance of corners or traverse points.

Staking Routines

The rover's software also provides robust staking routines that are similar to what is offered on other rovers. The routines are extensive and cover the extent of what a typical field crew would need for staking roads and new construction. I did not test the staking functions.

"Beast Mode"

JAVAD advertises that its rover can work in what it calls Beast Mode RTK. This is so unusual that JAVAD has filed a patent to cover the technology. Essentially, when functioning in Beast Mode, the rover makes ambiguity resolution up to 5 times faster because the base station transmits base data 5 times per second. This speed is not an extrapolation but a real rate.

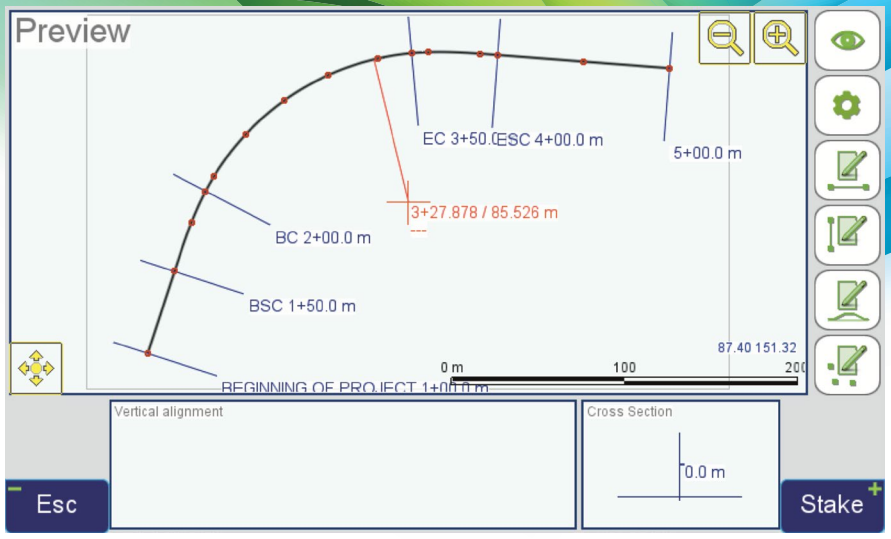


An example of the Arc by Three-Points COGO routine. Although distances shown are in meters, a user can quickly switch to US Survey Feet if desired.

Beast Mode RTK is available only when using the TRIUMPH-2 or TRIUMPH-1M base stations. JAVAD emphasizes that the 5-Hz Beast Mode RTK is totally different from the up to 100-Hz RTK that is advertised by other companies *after* ambiguities are fixed; in other words, this is not an interpolated calculation. JAVAD's characterization is that this function is like a turbocharger for RTK.

In extremely difficult cover it can reduce fix time by up to 80%. That's two minutes rather than 10. Or 12 minutes rather than an hour. I did test this mode in harsh conditions, but could not compare it directly to other maker's units as this option is available only from JAVAD. Suffice to say that I was pleased in several instances at both the rover's fix speed and the fact that I was even obtaining shots.

J-Field also allows a user to predefine the names and attributes of objects that are typically located. It does so using what JAVAD calls ShapeTags or Codes. Either of these functions allows one to build a data base of objects such as Iron Rod, Iron Pipe, Monument, Stake, Tree, CB, MH, Inv In, Inv Out, CATV, and on and on endlessly. Each of these can then have defined attributes. For instance, Rebar could have sub-options such as ⅜", ½", ⅝" and so on. Custom identification can also be made on the fly if a surveyor encounters unexpected objects. The feature is quite flexible and has a minimal learning curve.



An example of many road alignment options. The road stakeout routines are quite robust.

Support

I admit that support is a big deal for me. Too often I've reached out either to my local dealer or tech support from a large GNSS maker, only to be extremely frustrated. Support, as I have experienced it repeatedly over the decades, is too frequently a catch as catch can experience. It tends on average to be poor. And slow. None of that describes the JAVAD support.

JAVAD's support is literally the best I have ever experienced. It offers support in several ways. The most important is via what JAVAD calls its "Live Technical Support Team". During my review the team was composed of six individuals who are scattered throughout the US. Most of the team members are PLSs. All are highly responsive. I should know as, in the course of asking my many questions, I spoke to all but one of them. Their enthusiasm was infectious and their knowledge was laudable.

JAVAD has also created another unique support feature that is called RAMS (remote assistance), which allows one of the support team members to log onto your rover via a WiFi connection. The support member can then toggle through the software until the issue is found and resolved. . It's fast and a life saver if you are an hour into deep woods and have a question. By the way, RAMS can be installed on your own cell phone or office computer to allow live troubleshooting if a field crew calls in with a question. Imagine what that means. The time savings are more than significant. I installed RAMS on my iPhone in less than a minute at no cost (it is also available on Android phones).

RAMS is representative of the overall level of support from JAVAD, but also offered is an online forum for registered owners. It's heavily used and questions and answers fly fast and steadily. Many members of the Live Technical Support Team check in there daily.

Software Updates

Software updates are posted automatically to the rover. The Support area on the rover's homepage simply lights up if updates are available. Toggling *Update* allows the rover's WiFi to pull in the latest revisions to UHF, GeoData, GNSS, the Windows OS, J-Field and the J-Tip. It's fast and saves constantly checking a manufacturer's website for announcements of updates. On average during my lengthy review, updates came in every other week or so. They are free. Again, this is a slick feature that I really appreciated.

Training

JAVAD has created a series of videos, in addition to its printed materials (a full color User's Guide and a Quick Start Guide). The videos are professionally edited and feature Shawn Billings, a Texas PS with decades of survey experience. Billings is also part of the Live Technical Support Team, and has played a key role in the J-Field software development.

The more than twelve videos cover many essential topics, including hybrid RTK, points shift, photogrammetry options, offset surveys, localizations, base/rover setup and general software use. Billings has been adding new videos on an average of every three or four months.

The LS rover itself has Help screens associated with almost all functions of the software. If a surveyor needs a refresher on a J-Field function, the built-in help screens are useful.

Lastly, Billings has noted that the recent two-day JAVAD seminar in Arkansas is not the last he will be conducting. He hopes to increase the frequency and vary the locations to allow more surveyors to attend.

Ancillary Features

Lift and Tilt

One of the functions in the rover that I found helpful for quick locations was what JAVAD calls Lift and Tilt. The rover senses the angle of the monopod or rover pole. Once it is level, collection begins immediately. The user can then tilt the pole slightly to stop it. The action is fast and intuitive.

Collection of road centerlines or edge of pavement can occur in mere minutes. For instance, using this function I located about 30 points along a driveway at my office in about five minutes. Because points can be connected on the fly using either a line or curve toggle, the driveway was located and displayed correctly in the display.

Similarly, I tested the rover doing a quick topo routine, pre-configuring it to collect when the pole was level and to stop when tilted. This is faster than tapping Start and Stop and allows the user to move through basic survey collection rapidly. As Nate Dearyan enthused to me, *"It's a 4 man crew, in a box."*

Other Internal Functions

JAVAD's Triumph-LS has additional features that make it attractive. It has a patent-pending RTK verification and validation system which is designed to handle even the weakest signals when multi-path becomes an issue due to obstacles such as trees and buildings.

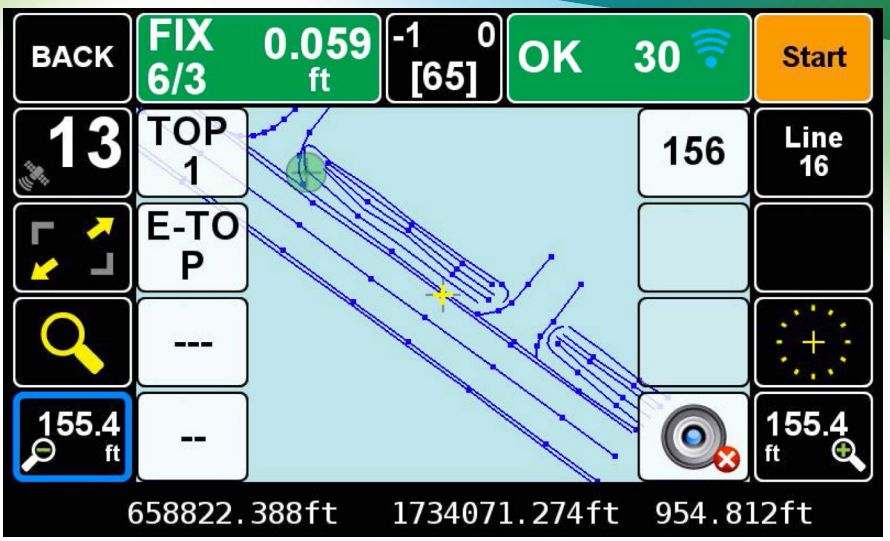
JAVAD does transformations and projections. The LS is preloaded with worldwide projections, but a user can develop a projection through the localization process for coordinates from a custom coordinate system, another unusual feature. The software includes very robust localization features. A large portion of the Arkansas seminar I attended was focused on the power of this single feature. Essentially, localization can determine the location of a reference station relative to defined coordinates. If using coordinates that are not geo-referenced, J-Field can create a projection from ground points.

Once you need to output file data, the LS shines. It can send files via bluetooth or WiFi into DropBox or a Google drive, or save to an external thumb drive. Files formats include DXF, DWG, Shp, Text/CSV, PDF and others.

Summary

For a professional surveyor the LS rover is a high precision scientific instrument that has been essentially repurposed by JAVAD for fast and accurate boundary and topographical work. Its customization features are unusual and powerful. Its ability to collect points in areas with high multi-path interference is perhaps unparalleled. If there was consensus from JAVAD users, it was that they had shifted from receivers made by other makers because of this factor alone.

The LS can work from a base/radio modem, or as an RTN receiver using a state or private CORS network, or off a commercial network such as SmartNet. It can be easily configured in multiple ways, depending on a user's location and demands. The receiver can switch from RTK to RTN in less than a minute. For instance, if a survey crew loses RTK because a base goes down, the crew can simply switch to RTN mode, or vice versa, presuming they have an available network.



An example of linework created using Point, Line and Curve options during collection.

JAVAD has world class support—frankly, the finest I have ever encountered. No inquiry I made to JAVAD during the course of this review went more than an hour without a response. As I mentioned earlier, service responses, in addition to being fast, were knowledgeable and enthusiastic. Having spent too much time trying to solve some random problem with other makers, for me this was refreshing, to say the least. Couple the superb individual service JAVAD provides with its unique RAMS application—allowing either JAVAD or a surveyor's office staff to connect live to the LS rover during the course of fieldwork—and JAVAD is a standout.

Regarding software, Darren Clemons, an LS user noted, *"The LS actually has more ability to control and keep track of what your field guys do than anything I've ever used. Back in the days of [older] software, when your guys brought in the days work, all you had were coordinates. With this Javad LS, you have the ability to look through literally everything and every point that was collected. With its ability to easily create a PDF job report, I can look at every screen shot (and many times attached photos my guys attach to individual points). With that, I can see the PDOP, number of satts, time, epochs and even a time stamp for each point collected."*

I should note that JAVAD has dealers set up around the country. Most are working PSs, not sales personnel. It's a unique and logical feature of the overall JAVAD approach—development of any GNSS system is best driven by professional surveyors, and equipment assessment for potential buyers is best determined by working professionals. That definitely describes JAVAD.

Last, JAVAD has had the foresight to create a team of working, professional American land surveyors—all of whom use the LS rover in their daily work—that constantly recommends software changes. From my conversations with four of these team members, JAVAD through its software engineers implements revisions quickly. Software updates do not occur yearly (at a cost to the user) but instead occur on an average of every six to eight weeks at no cost.

Between its hardware and surveying-oriented software, JAVAD is a unique, quality driven GNSS maker. Its founder, one of the giants in this relatively new field, has personally imprinted his decades of experience in the creation of the LS, down to the design of every screw. The JAVAD system is good enough to justify your own "test drive" as your company expands, or if you frequently work in difficult areas—or as your GNSS equipment ages out. ■

Patrick Garner is a Professional Land Surveyor in Massachusetts who has been in private practice for over 35 years. A principal of Patrick C. Garner Co., Inc., he frequently conducts technical seminars, does peer reviews for cities and towns, and works as an expert witness in Massachusetts courts. He also provides 18 on-line continuing education courses through RedVector, many of which focus on legal and technical issues in land surveying.