

Bellota Substation Mobile LiDAR survey in San Joaquin County California.

Thinking Beyond Our Senses

Mobile Lidar 2D/3D/4D Interoperability

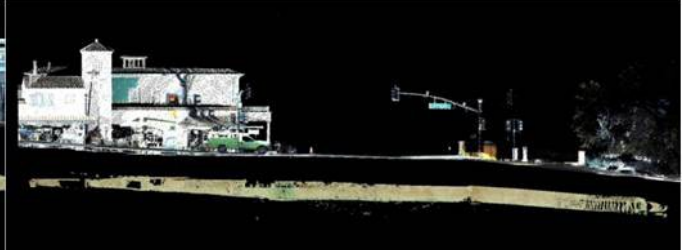
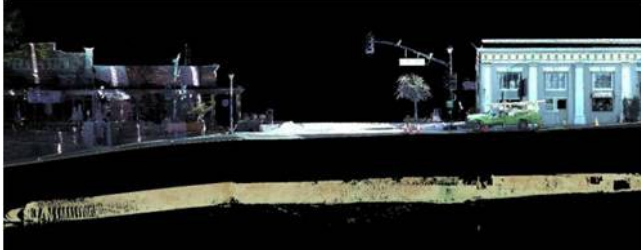
If we look out a window our visual perspective of the world is a 3 dimensional relationship, however, our ability to sense so many more tangible dynamics that are in play are what lead us to better decision making. The warmth of the sun, trees gently blowing in the breeze, the smell of the corner coffee shop can make the average day much more pleasurable. There is

also an inherent understanding that the buildings around us are occupied with business activity, pleasure and many other activities that at times are not seen when just looking through our eyes. The ground below us carries water, sewer, electric, cable, trains, and many other essential functioning utilities. Why then should we only expect our surveying methodology to give us just one 3D

orientation when there are so many more dynamics to sense that shape our decision making?

During the past decade of development of Mobile LiDAR, ground vehicle - based collection systems, many industry visionaries imagined full interoperability of all of our field surveying and data collection tools in a single collection system. That vision is now more than imagination, it is reality and we need even more sensing capabilities to help

BY JIM BRAINARD, PLS



Sutter Street, Folsom California above ground Mobile LiDAR and below ground terrestrial LiDAR merged product.



Sacramento Valley Rail line Mobile LiDAR survey from Historic Folsom.

our clients truly understand the complex environments they will be designing in.

System Sensors

In my early days as a geodetic surveyor in the Army I had the opportunity to work with gyro-azimuth theodolites, Doppler MX-1502 TRANSIT satellite receivers, tellurometers, microwave distance measuring instrument, and a Wild T-4 (even if it was only at Ft. Belvoir). As we look back at surveying technology for even the past 30 years you will see that electronic computer advancements have been a driving force of change. As Einstein stated, “Technological progress is like an ax in the hands of a pathological

criminal”. Advancement in processes and equipment will inevitably happen for the betterment of our profession. Also, pain in workflow, budgeting, scoping and deliverables is an associated risk for the weary geometrician, but this topic should really be saved for a future article.

High-tech advanced electronic sensor products are readily available around the world, offering many opportunities to merge multiple pieces of equipment into a single platform. As innovators, surveyors, mappers and service providers of geospatial products we need to question what we are doing, why we are doing it that way and can we merge technologies to create deliverables that

push our virtual concepts into fully integrated products. It may be that we know only one piece of the puzzle, like in most cases - this is 3D measurement and mapping. We have to look beyond our primary role to see if there will be additional information that could be obtained through a mobile platform.

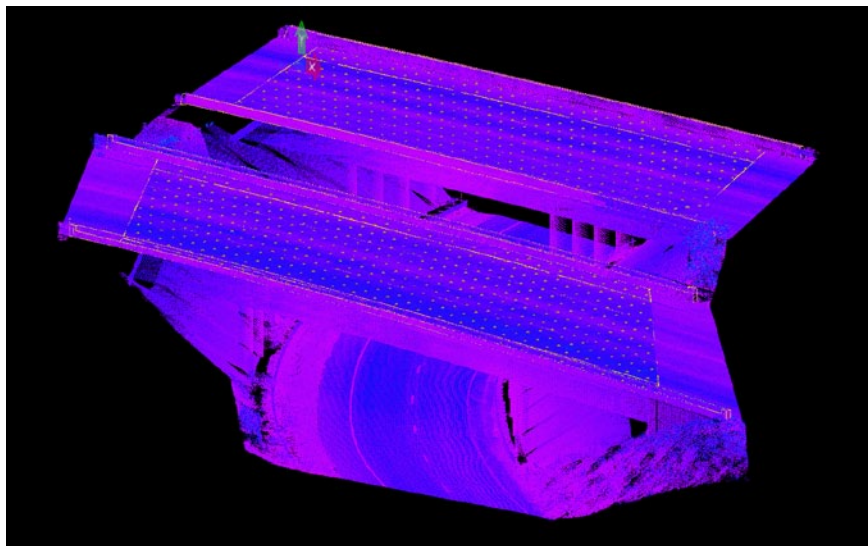
Like many companies throughout the world, R.E.Y. Geospatial is doing just that as we seek to merge the Riegl VMX-250 mobile LiDAR system with RTK, Digital Imagery, Thermo Imagery, Aurora Imagery, Electromagnetic Underground Imagery, Ground Penetrating Radar, Gas Leak Detection, and Multibeam Bathymetry. The end result of these application mergers is client - based products with single mobilization, geo-referenced collections of a project above ground, below ground, below the water, with geo-temperature readings and subsurface anomaly readings. In turn, this creates the need for product deliveries that reference and reflect creative and applicable 2D, 3D, and 4D collection opportunities.

Interoperability

True interoperability is the fusion of multiple systems for multiple

applications and multiple end users. It is defined as the ability of one system to use the parts or equipment of another system. I like to look at it as three separate avenues of interoperability. The first is the merger of equipment through linking of cables for data triggering, recording and formatting. This phase is by far the most important because of the simple nature of data being nothing more than a manufacturer's preferred alternative to express an output of information. Most Mobile LiDAR systems on the market today allow for alternative input or triggering through the use of 9 pin ports, lemo, USB, fire wires or other alternative cabling. I have to interject here. With today's advances in wireless technology shouldn't we be asking for more connectivity without the cables?

The second avenue is the integration of digital information. We have a few tail feathers that are going to get ruffled here but all in all it is worth stating. The educational, scientific and manufacturing community is fully aware that if you

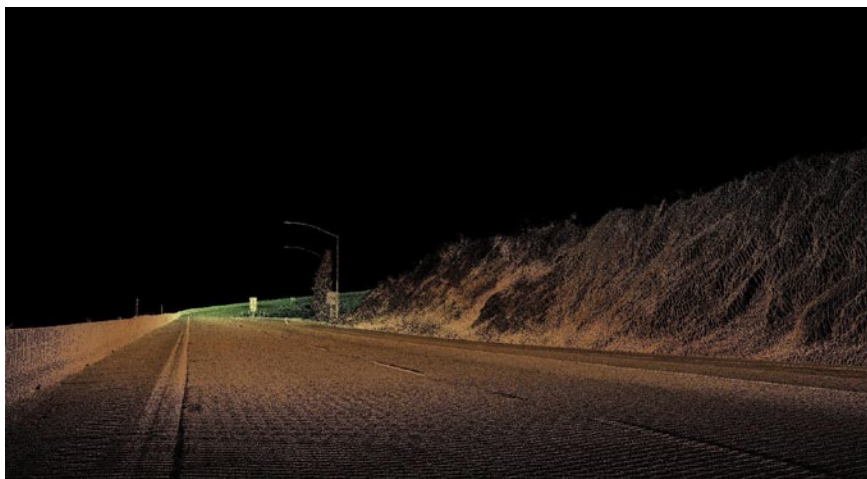


Mobile LiDAR interchange flyover Interstate 5 in Los Angeles County, California

get system integration at the levels of accuracy from a mobile platform that we are achieving today then all of the software and data formatting that has been accomplished sometimes puts you so far down a path that you can't backup to allow for additional integration. This causes uproar in the data formatting

community and another committee is formed to study the next version of data file formatting. This in turn can lead to issues between different manufacturers with some buying in because they were on the committee, and the others refusing to be compatible because they were left out.

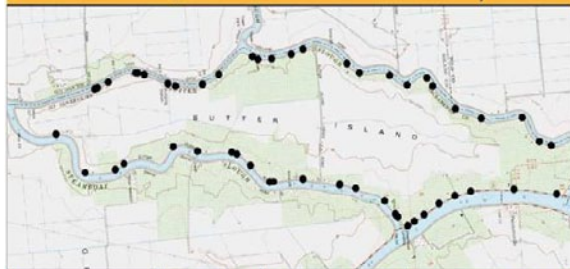
The third avenue is software and utilization of the information. I have described the collection of Mobile LiDAR data as a brand new Ford F150 dual cab truck, but the use of the LiDAR in a design capacity as four tires, a chassis and an engine. We desperately need this to come full circle from equipment, to collection to fully integrated use of the LiDAR point data. We have played the dance that either computers or software can't handle the amount of information from Mobile LiDAR data. What happens when we add more sensor data into the channel? We need to have adult conversations about these things because they are the means not the end.



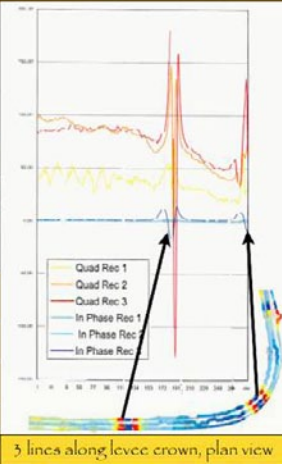
Mobile LiDAR survey of Interstate 5 in Siskiyou County California.

Cross-Checking Pipe Inventories

Verifying Presence of Documented Pipes & Finding Undocumented Pipes



Data Plot, Typical Pipe Signature



	O&M Manuals	Visual Field Check	Geophysical Cross Check
Documented	53	43	49
UNdocumented			21
TOTALS	53	43	70

Pipe Inventory, Sutter Island, RD 349 Sac-Sjo Delta

3 lines along levee crown, plan view

Electromagnetic Imaging of Levee Structure in Sacramento Delta Region.

Personnel

No discussion of interoperability should ever be absent the key ingredient - personnel. At ILMF in Denver I discussed the need for a Star Trek version of Scotty in your office. We have a couple -thanks Joe and Tom. These individuals are the ones that can make anything work together, output properly, troubleshoot

the minute details, and hold standards high enough that the client becomes a believer. They make our job easy as we perform business development and they make our companies look good on the product delivery end. They help us to think outside of the box and to imagine if we could just get that one system to integrate we could provide a better

service to our clients. Like the theme to the old show states "To go where no man has gone before".

Closing Thoughts

We have an opportunity to integrate sensors and data, which enables us to create market driven, customer focused solutions that truly allow for a one time collection with increased productivity. There is always the easy way and that my friend is simply to do nothing more than collect spatial information in 3D. Don't get me wrong, it is 'totally awesome' to drive down a road and collect spatially accurate information. It is great to collect a billion points and to create a topographic map that more accurately represents the terrain than had ever been imagined except by the original designer's mind. But is this it? Can we do more for the client? Should they expect more? My hope is that we never stop imagining. I hope you agree. ■

Jim Brainard has been a principal at R.E.Y. Engineers, Inc. for the past 6 years and is responsible for the public sector survey market. He has spent his entire career working on large public sector projects and is proud to have served his country in the United States Army as a Geodetic Surveyor.

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