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Newest Surveying Tech

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Advancement in engineering & surveying technology

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Advances in technology have made an impact in almost every area of human life. The fields of engineering and surveying have followed those advances at every step in the process in order to provide data at increased accuracy and speed.

Improvements in the GPS constellations and the availability of multiple systems allow for accurate positioning at any time during the day. Networks of Continually Operating Reference System (CORS) data provided by various agencies increase the efficiency of data collection. With these improvements, the advancement of mobile, stationary and UAV LIDAR technology has revolutionized the surveying and data collection fields and the future is unlimited.

Evolution of Surveying

The history of surveying dates to ancient times, even in Biblical era. ***Surveying is defined as the science and technique of determining the relative positions of points and or objects on, above or below the surface of the earth.*** Various methods and equipment have been used for surveying to accurately determine land boundaries and subdivide larger tracts of land into smaller parcels for potential development. During the early 20th century, surveying technology advanced at a steady rate, resulting in an improved ability to accurately map land yet provided insight into the possibilities that could be available with better technology.

In the late 1950s to early 1960s Global Positioning Systems were used in military defense systems known as GPS. GPS is the network that uses multiple satellites orbiting around earth to triangulate a position on Earth with coordinates. With the industrial boom and advances in space technology, engineering and surveying followed suit with the development of the computer. Since the 1960s, this particular devel-

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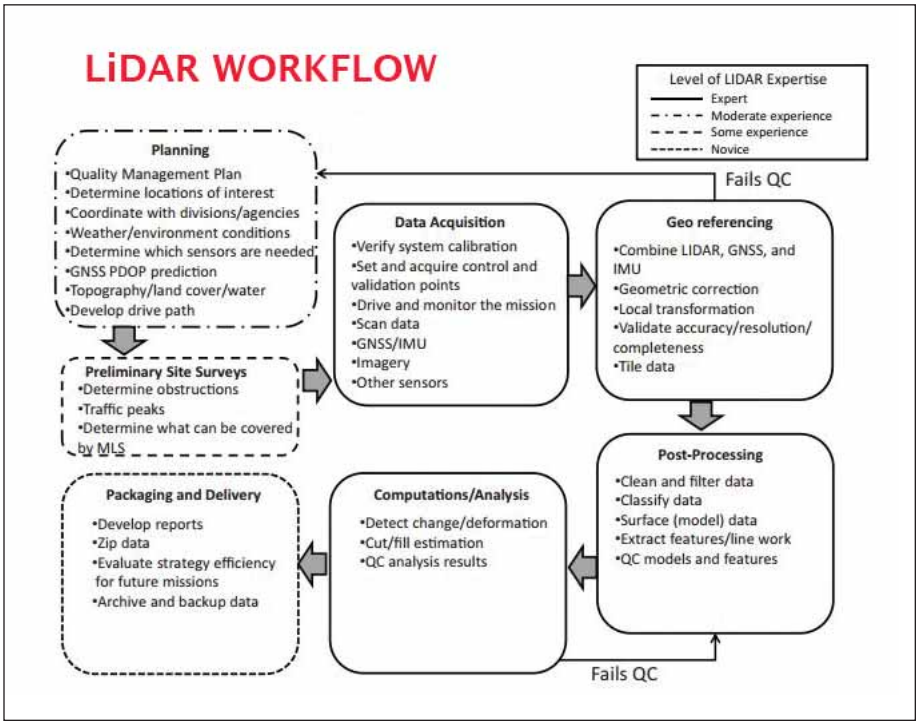
opment has been utilized throughout the world to advance technology into many applications which impacted our country and the world in almost every aspect. When released for public use, the computer was a game changer to the markets of engineering and surveying. This technology improved the short range of EDMI instruments and measuring tools, then combining them together to make "total stations" which became one of the most valued instruments used by surveyors. This made a significant impact on surveyors by reducing the amount of equipment while allowing mapping and layout with a click of a button.

In the early 1980s, surveying was redefined once again by evolving technology. The GPS was opened for civilian applications and uses. The Reagan Administration opened this service to the market utilizing its benefits of pin point coordinates on many resources. This era discovered Geographic Information Systems (GIS) that was developed in Ottawa, Canada and was used to record and map the land within the country of Canada. This tool was a program that ran on computers that built data bases to accurately map large areas of land. Surveyors can stream live information to the database and make corrections or add information for public use in timely manner.

In today's world of GPS and 3-D scanning, the early days with a chain and compass, and the alidades and plane tables might seem insignificant but these instruments and their dedicated surveyors played an invaluable role in the development of today's boundaries and the establishment of land ownership in the United States. Without them, the country's extensive infrastructure, resource management, and western settlement would not have been possible.

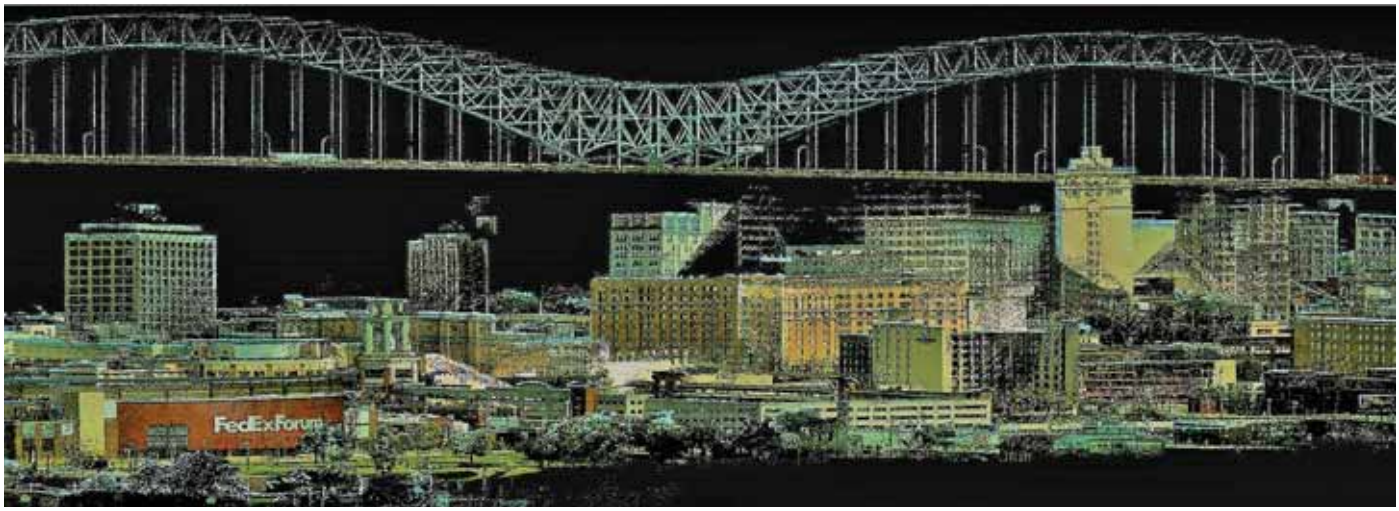


Future

While technology is changing daily, new uses in engineering and surveying are developing to correspond with the change. Engineering challenges and specific needs drive new developments in technology which further advance field survey operations and the cycle repeats itself again. Thus, creating software and equipment that is more intuitive and hands free while becoming more convenient and precise. Operations that were extremely complicated, time consuming and required tedious calculations decades ago are now performed instantaneously with the click of one button with visual displays that project 3D details that were once only imagined or drawn on paper in two dimensions.

Uses

One of the advances in technology that Sorrell-Smith Engineering Consultants LLC has found to be most beneficial for both survey data collection and engineering information is from the LiDAR technology. Whether utilizing a mobile truck mounted LiDAR (Light Detection and Ranging) scanner or an aerial UAV LiDAR drone, the sensor captures the



Colorized LiDAR Data of downtown Memphis

West Memphis Airport - Colorized LiDAR Data that has RGB value plus X,Y,Z. Original scan data used for existing site conditions.

LiDAR data is useful for original and final surveys of highways, rail lines, topography at mines and borrow sites, building and industrial sites, bridges and other structures for design, maintenance and as-built surveys.

surrounding environment at a rate of up to 700,000 pulses per second. The multiple rotating lasers cover the full 360° at a slight angle around the unit which the resulting data creates a 3D point cloud of the objects and surface with only minimal gaps in coverage. An Inertial Measurement Unit (IMU) processes data received from the GPS receiver to provide precise positioning and altitude for each point of LiDAR data. This point cloud data when processed provides data within State Plane Coordinates as well as vertical elevation all within acceptable tolerances for surveys.

This type of data has been found useful for original and final surveys of highways, rail lines, topography at mines and borrow sites, building and industrial sites, bridges and other structures for design, maintenance and as-built surveys.

QA/QC

From a data management point of view, the most difficult stages in the work flow are in the early stages due to raw data storage and processing of large volumes of point clouds. The post-processing step includes basic operations that are typically performed automatically and with limited user input or feedback. Of relevance to the management of large LiDAR datasets, are the operations of filtering and classification, because they generally apply to each individual data point. That is, each point can be assigned a classification or filter value. This contrasts with computations or analyses (e.g., extracting curb lines), which generally do not alter the fundamental point cloud information. Project workflows typically require use of several software packages, many of which are updated frequently. In general, easier-to-use software will have a higher initial cost in contrast to lower cost products which may have reduced functionality. The types and number of software packages needed depend on how much of the processing will be done in-house. Another important consideration is data interoperability between these packages and between software versions (not just for point clouds). In many cases, the geometry features may transfer effectively between packages, but attributes are lost. Finally, plug-ins can be obtained for many CAD packages to enable point cloud support directly within the CAD software, reducing the amount of training.

Time is Money

Technology such as the LiDAR and GPS work together to provide information with the highest accuracy in the shortest possible time. While this technology does not fit every project, it has developed such that a combination of the two technologies can typically be used for survey data collection to meet the needs and requirements for most any

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project. The time required to collect and process the LiDAR data has proven to be cost effective on large and medium size projects with completion time cut by 50 percent and in some cases, up to 75 percent. The additional data and photographs obtained during the LiDAR scan can often provide information from the site for the designers that prevent any return to the field to obtain missing data that might not have been obtained from a conventional survey. These return surveys are typically time consuming, non-productive and costly causing delays in design and survey productivity.

In order to meet the increasing demands of construction projects and engineering designs, as professionals we must embrace the new technology and seek out ways to utilize and manage this information to provide the most cost effective methods and best resources for our clients, owners and the public. ■

Sorrell-Smith Engineering Consultants LLC (2SEC) is a full-service engineering design, planning and construction management company located in West Memphis, Arkansas. 2SEC was formed in 2015 from Sorrell Consulting Engineers which was founded by Dennis Sorrell in 1992. Mr. Sorrell before his passing had over 40 years of experience in civil engineering practice having formerly been a partner with Bond Consulting Engineers for 20 years. Prior to acquiring the business Jim W. Smith had 23 years of experience in various engineering roles with the Arkansas Highway and Transportation Department in addition to 13 years with APAC Tennessee as the Engineering / QC manager.

Presently, the firm has seven employees including one licensed engineer, two CADD technicians, one administrative assistant and two survey crews with experience in all aspects of civil engineering, design, surveying, land development, planning, construction survey layout and construction contract management. Sorrell-Smith Engineering Consultants possesses the capability to assist a community and owners with a proposed project from inception to completion on virtually any civil engineering or planned project. 2SEC is an Associate Member of the Arkansas AGC. You can learn more at www.2SECLLC.com.

Part of Sorrell – Smith Engineering Team from left: Jerrad Burns, Jim Smith and Charlie Patton.