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TECHNOLOGY ADVANCEMENTS IN MAPPING

Technology advances today are moving at breakneck speed. It was only a few decades ago when GPS was introduced into the survey / engineering world, and now it has become a ubiquitous tool in every belt. Staying current with the technology trends is vital for any surveying or engineering company to prosper in this ever-advancing frontier.

The use of UAV and LiDAR technologies is no different, it has seemed to come at everyone from all angles and walks of life, from simple photo and video capture, all the way to redesigning an entire hospital in a 3D model environment. One of the biggest use cases for utilizing UAV (drone) technologies is the increased safety and minimization of putting crew personnel in risky situations. Less crew also means decreased production cost efficiencies, which is an immediate return on initial investment for clients. WLG introduced UAV into our geospatial program over the past eight years and has introduced UAVs as a standard field activity. WLG has developed distinct techniques and policies using this technology for planning, inspection, construction, engineering, and mapping processes for private and public projects.

One area of fast development has been the integration of mobile LiDAR units onto heavy lift UAVs. Terrestrial LiDAR scanning has been around for a couple decades, but only up until recently has the computer hardware and Artificial Intelligence (AI) software became robust enough to allow significantly faster acquisition and processing times. Mobile LiDAR is only as accurate as its Inertial Measurement Unit (IMU), which understands where the scanner is in space. Placing a mobile LiDAR under a UAV has reduced the time for extracting topographic and ground data from heavily vegetated areas where traditional photogrammetry (either UAV or plane) would not be able to penetrate. the dense foliage to “see” the ground. Along with the hardware, the software has also taken a big leap with many new AI driven packages being able to autonomously extract roads, vegetation, powerlines, curbs / gutters, and buildings all from classified mobile LiDAR data.

One case for using aerial LiDAR has been in the vegetation detection along high voltage transmission line corridors. It is essential that overgrown trees and foliage be at a certain setback distance from these easements to ensure there is no power failure or fire due to a low branch that got caught in the line. The utilization of hardware and software has

allowed pilots to autonomously program and fly the UAV and mobile LiDAR along the corridor to capture everything in sight, then bring it back into the office to have the AI software analyze foliage distance from the existing powerlines. Not only is there mobile LiDAR in the professional industry, you can see it being used in some of the newest Apple iPhone for assisting in their facial recognition (face unlock) software.

Other examples of UAV usage include a 3D surface mapping on ocean bluffs in order to better map the terrain so engineers can reinforce the soil (project details shown below) as well as utilizing an optical zoom camera to conduct inspections from a safe distance, all without having to put a person in an unsafe situation either over unstable ground or 100 feet up in a cherry picker. Other UAV system integration can include thermal cameras, cinema videography, Optical Gas Inspection cameras (OGIs), and even mobile LiDAR. Another use case that can compete with the traditional aerial firm would be doing stockpile or mining volumetric. Smaller sized projects of this nature can be handled by small rotary quadcopters, where large operations of 200 acres or more can be flown in house using a fixed wing airplane to achieve those long flight times both for corridor mapping and up to 3,000 acres.

For the City of Dana Point, WLG performed a topographic survey on an environmentally impacted area on a bluff overlooking the ocean. The difficulty with the specific location was that due to the nature of the crumbling land, it was decided to use photogrammetry from a UAV to conduct the survey. After the placement of the aerial target control around perimeter of the site, a DJI Phantom 4 Pro was sent up 150 feet to capture images at an overlap and sidelap of 85% and 75% respectively. The high overlap and sidelap is for the benefit of the post processing software to better extract key points from the images using the natural parallax of the moving camera. Low altitude photogrammetry can be just as accurate as any traditional topographic survey on the horizontal axis, and up to 0.1 foot accurate on the vertical axis. For the dirt bluff, these accuracies are more than enough to provide from a safe distance. After the image processing and stitching, the software exported an laser scan file (LAS) that can be imported into AutoCAD to extract the natural ground from vegetation and structures, and then a surface can be automatically generated from this dense data set. This process has drastically cut down time in the field with the data collection, as well as in the office with TIN surface networks. Another export from photogrammetry is the orthorectified image (a measurable, scaled, image with no lens distortion), which can be 10-20 times the resolution of Google Earth. These images are extremely useful for quick and accurate 2D mapping.

Staying up to date with the current technology is challenging in the fast-paced world but doing so can have substantial impacts for further growth.