

■ Mapping the 64 km (40 mi) powerline along the canyon (orange line).

Flying 60 Knots Above the Colorado River

by Mary Jo Wagner

When veteran pilot, professional engineer, and land surveyor Gary Grigsby took off from Rifle/Colorado in his helicopter last June to survey a canyon with newly fitted Leica Geosystems LiDAR sensor and digital camera, he harbored some doubt about how well the technology would perform over the challenging terrain ahead.

"Though I was confident in the abilities of the LiDAR and camera system, I was still unsure how the technology would acquire the very high accuracy and density required while the helicopter was constantly maneuvering," explains Gary Grigsby, president of Western Research & Development (WR&D), a small engineering and survey company based in Cheyenne, Wyoming. "But it was flawless. And that both surprised and impressed me."

The high quality results of that survey were also a welcome relief for Grigsby, who one year prior, had gambled that acquiring Leica Geosystems' ALS60 LiDAR sensor and Leica RCD105 digital camera would boost his small company's growth. "At the time, no other companies in the area were flying LiDAR or digital imaging surveys with a helicopter," says Grigs-

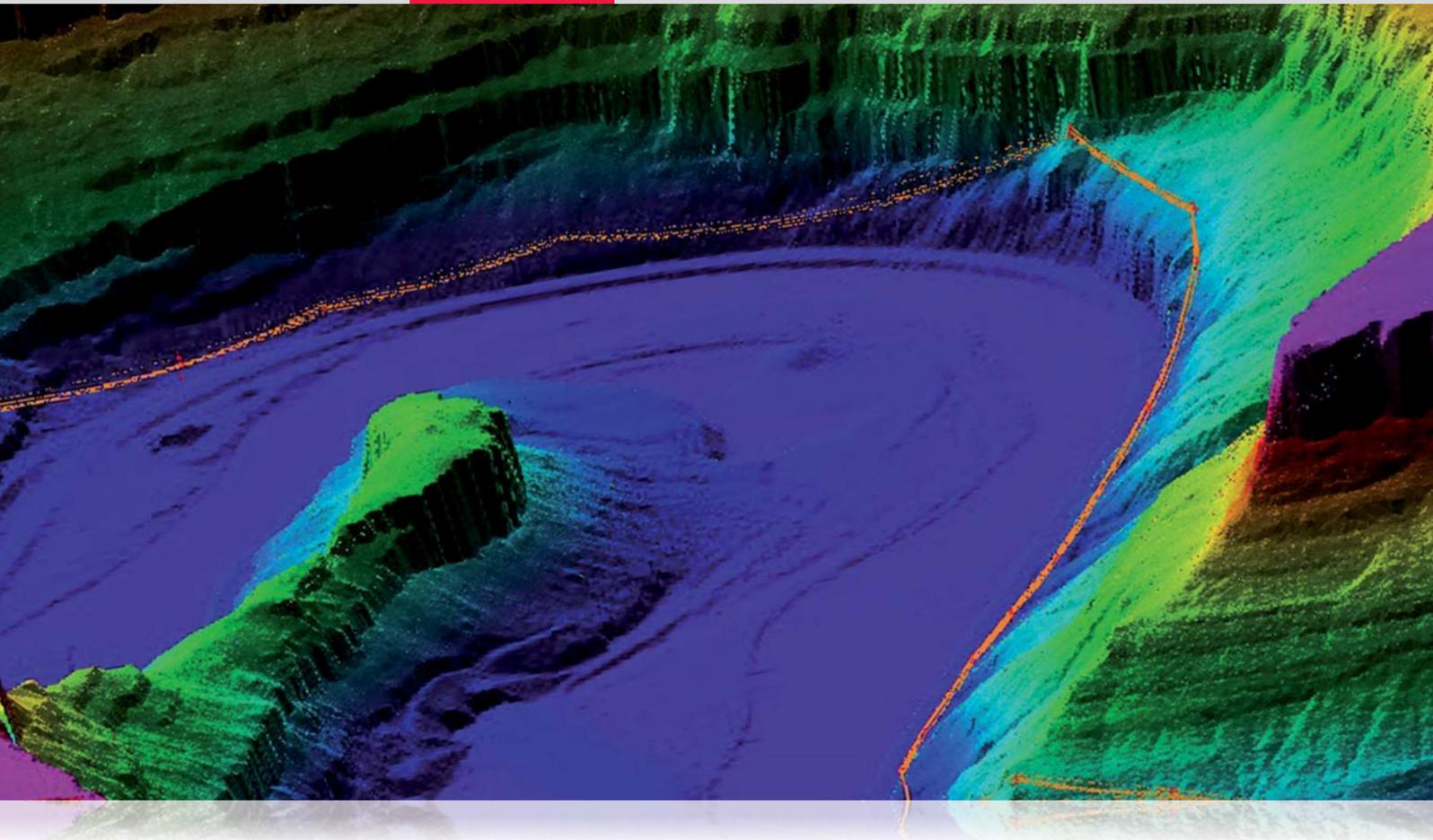
by. "That presented a business opportunity, but the investment was also a big risk for our small company. That's why I chose the Leica Geosystems airborne system. I knew it would bring us notable growth and new business."

Indeed, within only a few short months of fitting the Leica ALS60 sensor and RCD105 camera into WR&D's Bell 206L LongRanger helicopter, Grigsby and his colleague Alan Moore, a project engineer, were testing that risk in the Colorado canyon, meandering along the narrow corridor and hugging its walls – at times to within 61m (200ft) – at varying speeds, directions, and changes in elevation, to survey an existing power line. A veritable success in all aspects, the canyon project not only proved that acquiring the Leica Geosystems technology was a solid bet, it was the triumph WR&D needed to confidently pursue and pioneer new business developments and reap the rewards of an expanded service area, project portfolio, and revenue stream.

Rolling the Dice

WR&D was predominantly an aircraft instrumentation research and development company when it began in 1983. The R&D focus of WR&D has remained strong through its shift into civil engineering, surveying, and photogrammetry. While standard survey work has





been a steady part of its diverse portfolio, historically, WR&D has left photogrammetry and LiDAR survey work to other companies. And that was a wasted opportunity, says Grigsby. "As avid end users of photogrammetric and LiDAR data, we understand well how to acquire these data sources and how they can benefit our clients," describes Grigsby. "Acquiring our own technology would afford us the business development tool to enhance our core business offerings, challenge the status quo of traditional survey applications, and pioneer new uses of the techniques."

After a two year analysis of LiDAR and digital imaging technologies, WR&D chose to purchase both the Leica ALS60 Airborne Laser Scanner and the Leica RCD105 Digital Frame Camera, providing a versatile, high performance "plug and play" platform to collect very dense and very high resolution data. "With the helicopter's low air speeds and altitudes, we can capture up to 150 LiDAR points per square meter and come to within three-tenths of a foot (9 cm) vertically," qualifies Grigsby. "That's extremely high accuracy and density. And with the pod-mounted RCD105, we can collect georeferenced photography at a two-inch (5 cm) pixel resolution."

The Colorado canyon survey, commissioned by engineering, architecture and surveying firm Merrick &

Company, would be one of the first tests of this combined technology. Merrick tasked WR&D to capture 64 km (40 mi) of an existing power line with both the ALS60 and the RCD105 to ultimately create very high-resolution orthophotos, 30 cm (1 ft) contours and a classified LiDAR digital elevation model.

Into the Canyon

In preparation for the aerial survey, Merrick sent ground crews into the field to map the position of the transmission line on the ground and provided the base map to WR&D. For a better visual of the area, personnel pinpointed the path of the power line in Google Earth, cross-checked it with the base map and noted any "blind" areas – spots where the line couldn't be identified in Google Earth or accurately mapped on the ground – that would require extra attention in flight. They then created the most efficient flight plan using the Leica Flight Planning and Evaluation Software (FPES) and overlaid it onto a Google Earth map. In mid-June Grigsby and Moore flew to Rifle for the survey.

Every morning for four days, a WR&D surveyor would set up two Leica GPS1200 base stations while Grigsby and Moore prepared the imaging payload for the scheduled flight. Once in flight, Moore controlled the mission; monitoring the scanner returns and qual-



ity of the pictures in real-time, keeping a visual on the power line below the helicopter, and instructing Grigsby of any necessary lane changes. Grigsby says the stability of the Leica Geosystems airborne system was the one constant that they could confidently rely on throughout the ever-changing conditions.

"We would come across a plateau at 61 m (200 ft) and suddenly the ground underneath would drop down to 300 m (1,000 ft)," he says. "Those drastic changes in elevation cause constant up drafts and down drafts and wind shifts, causing our flight speed to



vary and requiring frequent on-the-fly adjustments. Throughout it all, the Leica Geosystems system performed perfectly. It automatically compensated for our variations in speed and elevation and alerted us if we exceeded speed."

Flying at an average speed of 111 km/h (60 kts) and 460 m (1,500 ft) above the Colorado River, the team collected about 250 GB of raw LiDAR data – at 20 points per square meter – and photographs of the winding power line from Rifle to Grand Junction. As the Leica RCD105 camera collects imagery in synch with the Leica ALS60, the two data sets were automatically tied together geographically by the on-board airborne GPS and inertial measurement unit, as well as with GPS base stations, eliminating the need for ground targets and streamlining the post processing.

After each flight, Moore downloaded the data and performed quality control to ensure they had the coverage, accuracy, and data density needed. They then sent the data to Merrick for post processing. Knowledgeable themselves with LiDAR and photography, the Merrick team was impressed with the accuracy and quality of the data sets.

"With the RCD105 imagery, we developed natural color orthophotos at a quarter-foot (8 cm) resolution," says Roger Hanson, director of operations at Merrick, based in Aurora, Colorado. "That's very, very high-resolution imagery."

"Quite simply, the capabilities, features, and quality of the instruments allowed us to successfully complete this project," concludes Grigsby. "Leica Geosystems provided us with a complete LiDAR/digital imaging package and have backed that with quality service."

Indeed, though WR&D is reaping the rewards of its successful gamble, it is unlikely Grigsby will try to transfer that winning luck to a blackjack table. ■

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