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SPECIAL ISSUE

DRONES TO DATA & AUTONOMOUS CONSTRUCTION

50 YEARS of INNOVATION

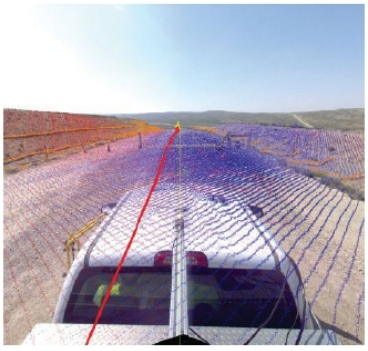
is developing the road robot in partnership with SGN, a gas distribution company in the United Kingdom. Equipped with underground sensing, the robot cuts the road surface, performs vacuum excavation, works on the pipe or other asset, then backfills and reinstates the surface. RES will undergo field trials in the first quarter of 2021.

ON THE JOB

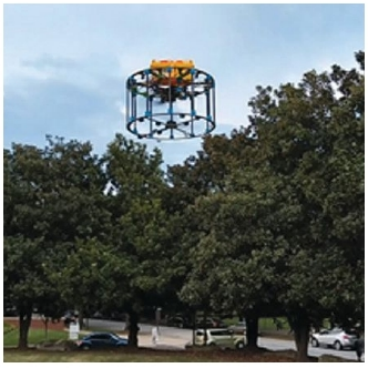
Derek Smith, lean innovation manager for international contractor Mortenson's Civil Group, believes solar and wind projects are ideal proving grounds for autonomous equipment and data management best practices. "These [renewable sites] are typically very large and in remote areas, so staffing can be tricky. As well, tasks such as turbine foundation excavation are very repetitive. The idea of a robotic excavator capable of digging those foundations is very appealing."

With that in mind, Mortenson has worked closely with industrial automation company Built Robotics for several years to assess the feasibility and deployment of autonomous capabilities for excavators. Results from the most recent implementation—a wind farm development project—were impressive. Using a smaller excavator, 21 of 229 holes were done fully autonomously and in about 10 hours each from digging the hole to finishing the pedestrian and equipment ramps. While Mortenson operators can dig foundations in about five hours with a bigger piece of equipment, the opportunity to use multiple excavators at the same time opens the door for impressive productivity gains and a safer, less physically demanding workload. "Our operators can monitor more than one robotic excavator and these machines can feasibly run 24 hours," Smith said.

At first, operators were hesitant to accept the autonomy. "Our operators work closely with [Built Robotics] engineers to develop the optimal excavation strategy, from digging the hole to managing the spoils," Smith added. "We made them part of the process and reinforced that these machines are a supplement to their job and minimize wear and tear on their bodies from long shifts sitting in a cab. Now, they're really excited."



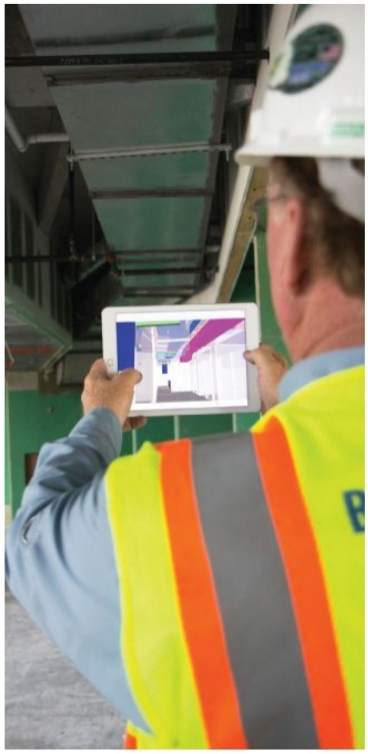
Mortenson is pulling topographic information from the Trimble MX2 mobile mapping system along with data from equipment and field applications into one virtual platform to enable smarter, more efficient construction.



Researchers at the Georgia Tech School of Building Construction are developing a drone capable of flying 5 miles and carrying a 100-pound load to support last-mile jobsite logistics.

Mortenson's next autonomous system implementation will involve trenching on solar jobs for wiring and cables, and will begin this year.

In a quest to assess the practicality and best practices for deployment of autonomous systems, a consortium of Skanska Norway, Volvo Construction Equipment, research organization SINTEF and construction software company Ditio is using the massive, three-year E16 highway project in Norway as a living lab to explore how machine learning, route optimization and AI could eventually replace supervisors using walkie talkies. As Lars Horn, project leader with Skanska Norway, stated, "Once the algorithms can handle the simple tasks, supervisors will have more time available to use their skills to solve the most demanding bottlenecks."



Balfour Beatty is looking to LiDAR laser scanner-enabled tablets to help facilitate more digitally connected jobsites.

PAYLOADS AND POSSIBILITIES

Drone spending is anticipated to reach $1.4 billion in construction this year alone. While predominantly used to survey sites and perform volume calculations, these flying robots are capable of much more.

On the topic of UAS, White House Fellow Voeller pointed to the need for more advancements, such as 25-pound payload units that can stay aloft for 30-45 minutes, or a drone that can be partnered with a battery rack system that allows the drone to

Photos courtesy of Mortenson, Georgia Institute of Technology and Balfour Beatty.

return home, swap batteries without human intervention and then return to its work.

Researchers at Georgia Institute of Technology are seeking to establish the framework for developing such next-generation, technology-enhanced solutions. The lab has already used small-scale aerial drones as tools for exploring potential benefits to safety managers within construction jobsites. The CONECTechLab at the School of Building Construction is collaborating with Rotor X and OptimAero on a research program to develop a drone capable of flying five miles carrying a 100-pound load. A version of the drone was tested at Fort Benning, Georgia, earlier this year.

"We see particular value in last-mile logistics on a jobsite," associate professor Javier Irizarry said. "Instead of forklifts or heavy equipment being used to move tools, materials and supplies, these systems equipped with autonomous navigation could provide near-real-time services."

While predominantly used to survey sites and perform volume calculations, these flying robots are capable of much more, and technology-adept company's such as Balfour Beatty's Texas-based commercial construction group are actively exploring new opportunities.

The Balfour Beatty group has gone from one pilot to 10 in the last year, and has provided drone capabilities on all 10 of its currently active projects. "We're seeing drones come full circle in terms of capabilities," Dominic Corrado, the company's director of construction technology, said. "Not long ago, it was primarily used for taking jobsite images, with little value to improving the construction process. Now we can program automated flight routes and automatically produce point clouds. It's truly a democratized platform from which we can leverage all the information gathered."

Corrado's group uses a geographic information system (GIS)-enabled platform to support flight planning, image processing and analysis. "Instead of having to figure out a coordinate system and translate data into intel," he added, "everything happens automatically. Simply put, it's easier to leverage the data."

Corrado also sees the addition of "layers" to the drone-enabled data gathering. "Beyond volume calculations, project progress tracking and site logistic planning, application developers are introducing new capabilities that provide real intel, such as the active identification of sleeves or rebar placement, which opens the door for improved quality control."

DEALING WITH DATA DELUGE

As reported in FMI's "Big Data=Big Questions for the Engineering and Construction Industry Report," 95.5 percent of all data captured (including from drones) goes unused, 13 percent of construction teams' working hours are spent looking for project data and information, and 30 percent of engineering and construction companies are using applications that don't integrate with one another.

Consequently, the adoption of technology will require the construction industry to rethink its normal practices, focusing on better data management, not application adoption.

Balfour Beatty's Corrado sees advancements such as tablets that incorporate a LiDAR laser scanner as a facilitator for delivering a more digitally connected environment. "The availability of LiDAR on a common platform will open up the LiDAR sensor to the whole app development marketplace. It's going to be a shot of nitro for the LiDAR industry that I believe will democratize the gathering and use of the data. With that kind of development infusion, a robotic system that uses LiDAR will see tremendous evolution in the way data is gathered, transmitted and, most importantly, assimilated."

Mortenson's Smith summarized: "Our challenge is to gather, process, sort and make it accessible in a single point of location where we can analyze and make decisions. We're pushing technology integration to facilitate a virtual living, breathing jobsite. It's all about telling the story about data that's collected. If you can't tell the story, you can't make effective decisions." ■