Storm Chaser

Erik Dahlberg recounts how adaptable technologies helped tame the 'Beast from the East'

As Ted Harland loaded his vehicle, he knew he was headed into some atrocious weather. It was 4:00 a.m. in March 2018 and he faced a four-hour drive to the jobsite, a stone quarry near Glasgow. Harland had conducted surveys to gauge earthwork at the site for several months, but this day's visit would be especially challenging.

Scotland is known for harsh weather, but this latest storm, officially named as Emma, had already been dubbed "The Beast from the East." It would hammer all parts of the British Isles over a two-month period with high winds, freezing temperatures and driving snow, but Harland could not allow the elements to deter the work. He had committed to his client to collect data for monthly analyses and had to anticipate which tools would be needed. On that dark morning, some choices he had made a few months earlier would prove to be very wise.

In the 12 years since he opened his company, Tri-Tech Ltd., Ted Harland has concentrated on providing high-quality geospatial services to clients in the public and private sectors. Based in Yorkshire, Tri-Tech's work includes engineering and topographic surveys, machine control, scanning and aerial imaging. From the outset, Harland has focused on using new technologies. "We've always used the top-end gear," he said. "It gives us the edge over our competitors." With a wide assortment of top-level survey instruments at his fingertips (see sidebar), Harland was ready to face the storm head-on.

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Top: Storm Emma blankets Duntilland Quarry in heavy snow. Photo: cc-by-sa/2.0 - © Alan O'Dowd. Lower left: SX10 and R10 at the quarry. Lower Centre: The SX10 collects scanning data during the blizzard. Tri-Tech used polygon-defined scanning regions to reduce time in the field. Lower right: Blizzard conditions prevented the use of UAVs

Capturing a snow-bound quarry

Tri-Tech had been working at the Duntilland site near Glasgow - one of Scotland's largest mainland hard rock quarries - for several months prior to that snowy day in March. Its client was an earthwork contractor handling the removal of the overburden that covered the quarry's valuable stone. Tri-Tech's client needed regular measurement to determine the volume of overburden that they stripped and moved. Once the layers of peat and clay were cleared, drilling and blasting teams could begin. To keep quarry operations moving, Tri-Tech needed to conduct its measurements in a narrow time window.

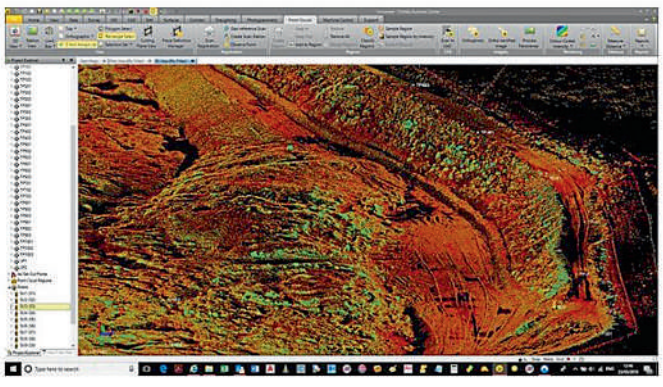
On most visits, Tri-Tech crews used a quadcopter UAV to capture aerial images of the site and, that morning Harland had, as usual, stowed the UAV in his van. Almost as an afterthought, he added the company's Trimble SX10 scanning Total Station to the load. Months earlier, when shopping for a new instrument, he had recalled instances the previous year when efforts to use the UAV were stymied by weather or other constraints. He thought that the SX10 might be useful in those situations. "I had the UAV in the van and I looked at the SX10 and thought well, it's not going out on other jobs today so I'll take it just in case." The van also carried a Trimble R10 GNSS receiver and foul weather clothing.

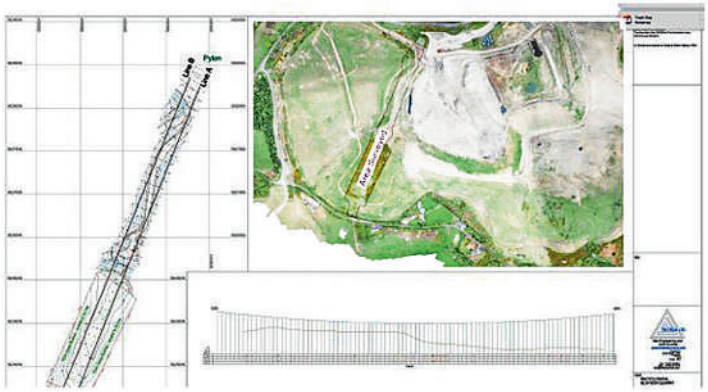
The weather forecast was accurate: the quarry was blasted with high winds and driving snow. Aerial imaging was out of the question and walking on the site would be slow and hazardous. The topography of the Duntilland quarry enabled Harland to establish 10 stations that provided a complete view of the area. Using the R10 and Integrated Surveying, he tied each setup of the SX10 into the mine's coordinate system. At each location, he used a polygon to define the area to be scanned. The SX10 then automatically conducted the measurements.

Harland needed roughly three hours to complete the scanning on the 55,000 sq.m. (13 acre) site. He said it took about an hour longer than flying the site with the UAV, but they made up the time in the office, where Harland used Trimble Business Center software (TBC) to combine the field data into a single point cloud and develop a terrain model of the site. "With the UAV, it takes 12 hours of computer processing time to generate point clouds from the photos," Harland explained. "By contrast, the SX10 data is already registered to the grid and the point cloud is basically completed in the field. So while it took an hour or so longer on site, the deliverables were actually a lot faster than the drone." The results provided to the client included an analysis of how much material had been moved to date, a drawing with a volumetric report, and a height-shaded drawing.

The Flexible consultant

Tri-Tech has attracted a knowledgeable but demanding, clientele. "When a client comes to us they want a one-stop shop," Harland said. "They don't want to go to one place for utility mapping and then another to get scanning or aerial imaging." He added that many clients know exactly what they want. For example, they'll ask for a georeferenced aerial mosaic of a site as a deliverable with a 3D point cloud of selected structures, a topographical survey of the rest of the site,





Left: Detail of point cloud from the quarry survey. Precise positioning of the SX10 significantly reduced the time for office processing. Right: Deliverables for survey of overhead power lines include contours, profiles and orthophotos

and a full utility map of the entire area.

It's also common for clients to ask Harland about the best approach to a project. With access to multiple technologies, he can comfortably recommend a preferred solution. "I want a win-win situation," he explained. "We look at ways to save our clients' money by doing things faster and more efficiently. That way they get better value for their money." As an example, he described using the SX10 for construction layout.

According to Harland, Tri-Tech does a lot of site engineering and setting out. For example, contractors working on a new commercial development in North Yorkshire asked Tri-Tech to guide the installation of anchor bolt jigs and boxes into the building foundation. As concrete was poured, Tri-Tech surveyors ensured that the anchor bolts were on the correct line and level and that the finished concrete was at the proper grade.

Day-to-day tool

"Normally we would just use a standard robotic instrument," Harland said. "But that day we didn't have one. So the SX10 went out and performed well as a setting out tool. That's the beauty of it—we can use it as a day-to-day tool for setting out and topography. It gives us the flexibility to save money for our clients."

With the quarry work coming to a close, Tri-Tech is finding new applications for the SX10. The business recently completed a survey to capture the location and diameters of trees and stumps on a 6,000 sq.m. (1.5 acre) parcel. The crew set the SX10 on a horizontal band scan and, from just four locations, were able to digitise every tree as well as the top and bottom of surrounding embankments. Harland said they realised significant time savings and captured plenty of additional data with no cost or effort. Other applications include panoramic imaging and scanning for highway surveys and topographic mapping. Tri-Tech also uses its scanning capability to precisely locate overhead power cables and prepare plan/profile information for utility operators.

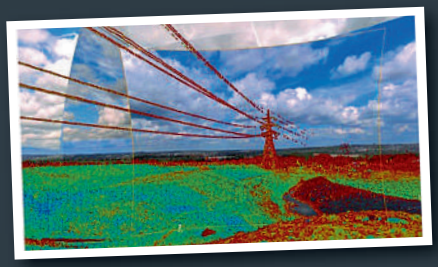
Harland says he will continue to push the technology envelope. "It's horses for courses," he concluded. "We work all over the country and have learned how to select the optimal tools for each project. As technology advances, we will take a hard look at what it can do for our clients. This really sets us apart from other surveyors."

Erik Dahlberg is a writer specialising in the geomatics, civil engineering and construction industries

Equipped for Growth

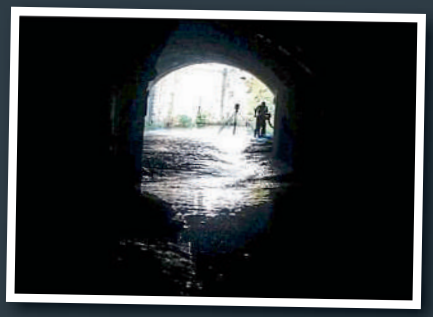
Tri-Tech owns a variety of gear including robotic total stations, GNSS, 3D scanners and an unmanned aerial vehicle (UAV). The staff of 15 consists mainly of generalists skilled in multiple geospatial disciplines and technologies; they are supplemented by specialists in machine control who handle modeling, site calibrations, machine setups and establishing GNSS base stations for construction contractors. Other specialists handle the bulk of the laser scanning and processing. In addition, Harland has dedicated a team to handle utility mapping projects, which make up roughly 60 percent of the company's work.

Harland has recently seen an increasing role for laser scanning as well as more conventional ground data. For example, Tri-Tech commonly uses total stations for topographic surveys of complex sites or industrial facilities. Capturing needed detail using total stations (including direct reflex measurement) can be time consuming and Tri-Tech often uses laser scanning to supplement the total station data.



Field data and panoramic image for survey of overhead power lines. Long range scanning reduces field time in capturing large spans

Similarly, infrastructure work and highway surveys benefit from discrete points captured with GNSS or total stations combined with scanning or even aerial imagery. Harland said they keep their Trimble TX8 scanner busy and clients are pleased with the results. When the time came to purchase a new surveying instrument, he selected a Trimble SX10 scanning total station.



A Tri-Tech crew captures scanning data at a tunnel portal. The company owns a dedicated scanner and a Trimble SX10 scanning total station.

Harland cited the ability to combine scanning into a traditional total station as a key aspect of his decision. "I didn't just buy it as a special piece of gear," Harland recalled. "I bought it because we were a total station short at the time. I reasoned that when it's not scanning, then we need it to work as a total station." He identified jobs that would be a good fit for the SX10, such as water treatment works with complex piping and structures. The snowstorm in Scotland added to the list of applications for the new instrument.