CASE STUDY

Taming a monster – large-scale RTK corridor mapping in remotest Australia

Geospatial projects don't get more intense than Survey Group's eBee RTK drone survey of the Talawana Track road where, aside from the project's enormous scale and complex logistics, dusty terrain and the threat of bird attacks also had to be overcome

In the Australian winter of 2015, Survey Group was contracted to conduct a 250 km long, 400 m wide corridor survey, which followed the Talawana Track Road, west of Lake Disappointment, through the Pilbara region of Western Australia.

The client, Reward Minerals Ltd., required 3D data in the form of a 1 m x 1 m DSM grid, plus orthophotos, for a road feasibility study. It specified positional accuracy of +/- 100 mm, with survey controls to be installed every five kilometres along the corridor.

Prior to using senseFly drones, Survey Group would likely have employed conventional aerial photography for such a job, in the form of a manned fixed-wing aircraft.

"We don't have the equipment for that type of survey so we would've had to contract this work to a third party," says Ben Simpson, the managing director of Survey Group and the Talawana project lead. "However, having eBee drones in-house means we can now compete with that market, which we couldn't previously due to the capital expense and specialist experience required."

> "Having eBee drones in-house means we can now compete with that [manned aircraft] market"

Bush methodology

Simpson engaged two drone operators and two spotters for the project, with himself the chief pilot and co-ordinator. The team needed to operate completely autonomously in the outback, surveying for three weeks straight, camping overnight at pre-designated base camps—and all without access to services such as electricity, internet, cell phone coverage, bathroom facilities and running water.

"We flew two eBee RTK systems, with a standard eBee for backup," Simpson explains. "On-site, we had rain the first few days, so we used this time to establish control points, commencing flying on July 22nd and finishing flying on August 7th."

The 250 km corridor. (Image: Google, Map data: Landsat.)

The team's methodology was to divide the full 250 km corridor into 2 km flight sections. "When we arrived at each base camp location, we had a team go out first and record a GCP at the centre of each 2 km section using an RTK GPS. At the same time we located the existing road with the GPS to compare vertical heights to the processed eBee heights, for quality control, and we set check points every 20 metres," Simpson says.

To map each 2 km section, he continues, "Our base station was determined via RTK surveying to set the reference point of each flight, from where it would stream RTK correction data to the drones for each photo they recorded. An eBee RTK was then launched from this location, with each flight covering 1 km in either direction of this central point." Two teams mapped different sections simultaneously using one eBee RTK each.

"In the drones' eMotion software we set flight lines perpendicular to the wind because flying with crosswinds helped us to collect the best imagery, giving more even photo overlaps and also extending battery life. This result was that we typically flew two 22-29 minute flights in each flight area, depending on the strength of the wind," Simpson adds.

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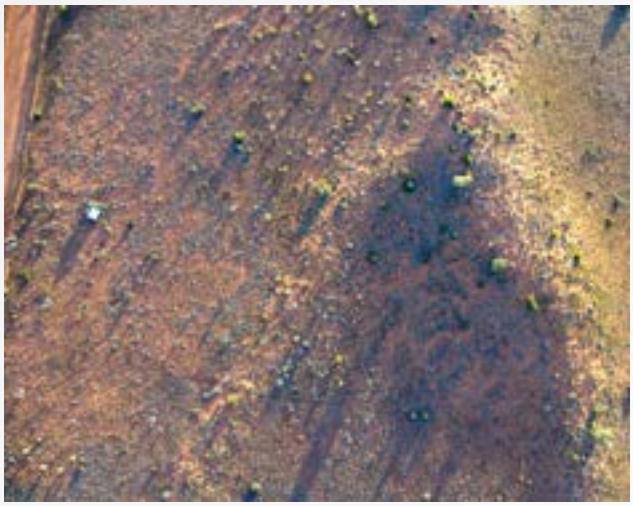

One of the project's individual images, featuring a GSD of 5 cm/pixel.

The two drones captured a total of between 350 and 400 images per 2 km section of corridor. The team set the desired ground resolution for these shots at 5 cm per pixel, with forward and lateral overlap of 75%. "These eMotion parameters allowed us to achieve maximum accuracy while balancing this with the time required to fly each flight zone," Simpson says.

Listing the challenges

Undertaking such an enormous project, in such a remote spot, meant life was unlikely to be simple though. Indeed, the project featured a plethora of challenges to overcome.

"We had to deal with the different wind directions, wind speeds and rain conditions, plus flying between 15 and 18 flights per day meant battery management was also an issue," Simpson says. "We had power inverters in our vehicles to charge the drones' batteries as we went, with 11 batteries for each plane, but at times there was still downtime while we waited for them to charge."

A trailer breakdown deprived the team of two full days and, as can be the case in remote Australia, bird attacks were also a threat. "In the past two and a half years we've flown more than 300 eBee flights, so we've lots of experience. That's why we knew we needed spotters when flying in the Pilbara, because the wedge tail eagles there are very territorial and like to attack the drones."

To counteract this risk, the team made several modifications to its drones to make them less enticing to feathered observers. "We stuck a red and yellow circle with an 'eye' in the middle onto each wing to try and deter the birds. The white stripes were to protect the drone's battery, radio tracker and camera in case the drone was grabbed, dropped and crashed hard onto the ground," Simpson says.

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One of the team's customised eBee RTK systems, designed to repel feathered invaders.

To the team's delight, this new strategy seemed to work. "We had no major eagle incidents during the entire three week trip—a welcome relief!" Simpson reports.

The last challenge was technical issues, in the form of sticking camera shutters—a result of the region's fine-grained soil getting into the sensor housings—and a problem with motor housing sleeves.

"We spent four days of the three weeks doing re-flights," Simpson says. "For the shutter problem, we actually found it better when the drone landed in the spinifex [a spikey grass plant] as this provided a soft landing without any sand or dust getting into the camera. We also started catching our eBees when they landed."

Initially the team caught its drones for fun, but when shutter issues occurred this method of landing was a good way to keep the eBees' sensors out of the sand and dust.

Generally, the team was pleased with the durability and performance of its senseFly systems. "We like that the eBees are easy to transport, quick to set-up, the software is excellent and the new RTK functionality works great. They're just a good option for our style of work," Simpson says.

Serious processing

With each flight complete, its 350-400 images typically took between one and two hours to process, with 50% of this work carried out on-site in a dedicated processing corner of the team's camp (*below*). The two laptops used were capable of processing approximately ten 2 km corridor sections per day.

50% of the project's data processing was carried out on-site, using the two PCs on the left, running the drones' supplied Postflight Terra 3D software.

Project workflow

- Mobilise all equipment to site
- Set-up base camp (4 in total)
- Establish GCPs, check points & survey controls
- Set-up RTK base station over known control
- Travel to flight location
- Measure RTK known position for RTK eBee base
- Create eMotion flight plan from pre-existing KML
- Fly drones (covering 1 km in each direction)
- Land drones, download images & flight logs
- Process flight data
- Move to next corridor section

Base Camp 3, located 170 km along the project's 250 km corridor.

Cost-effective accuracy

After three weeks of dusty in-field work, Simpson and co. finished up the remainder of the project's data processing back at the firm's Perth HQ. Survey Group then handed over the project's deliverables —orthophotos, a 1 m* 1m DSM grid, contour maps and more—just five weeks after starting the job.

"The cost of mobilising a manned plane to achieve the same results, while quicker, would have been at least 30% more expensive," Simpson says. "As for terrestrial surveying, I believe our results with the eBee RTK equal what we might have achieved with a GPS survey due to the point density we achieved; the majority of the eBee's points would be within +/-50mm, with some spikes at 150mm to 200mm. Terrestrial laser scanning might have achieved more accurate results, but it wouldn't have been able to handle the corridor due to trees, and LiDAR would have been an option too, but this would have cost more just to achieve the same results."

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The return on the company’s drone investments to date, Simpson concludes, has been highly positive: “We have invested approximately $160,000 on drones over the last two years and generated $300,000 in fees.”

A section of orthomosaic from the final few kilometres of the corridor (checkpoints noted in black).

A section of contour map, showing a small region close to the end of the project’s corridor, as supplied to the client.

About Survey Group

Survey Group (www.surveygroup.com.au) is an industry leader in quality survey consulting within Western Australia. With a portfolio and expertise that extends across minerals, energy, construction and civil engineering, it is uniquely positioned to deliver specialist advice and surveying. The company utilises the latest technology, such as the senseFly eBee RTK, to push the boundaries of performance, achieving reliable, accurate data and cost savings for its clients.

PROJECT STATISTICS

- **250 km x 400 m** corridor
- **2** eBee RTK drones
- **5-12.5 m/s** wind speeds
- **380-460 m** AMSL
- **5 staff** (2 per drone, 1 in office)
- **3 weeks** in the field
- **254** flights
- **25 min** avg. flight time
- **5 cm/pixel** ground resolution
- **RTK methodology:** local base, known position
- **125 GCPs**
- **5 weeks** data turnaround
- **+/- 100 mm** geospatial accuracy

Discover eBee RTK:
Learn more at www.sensefly.com/drones/ebee-rtk.html

Get the newsletter:
Register for our regular email update at www.sensefly.com

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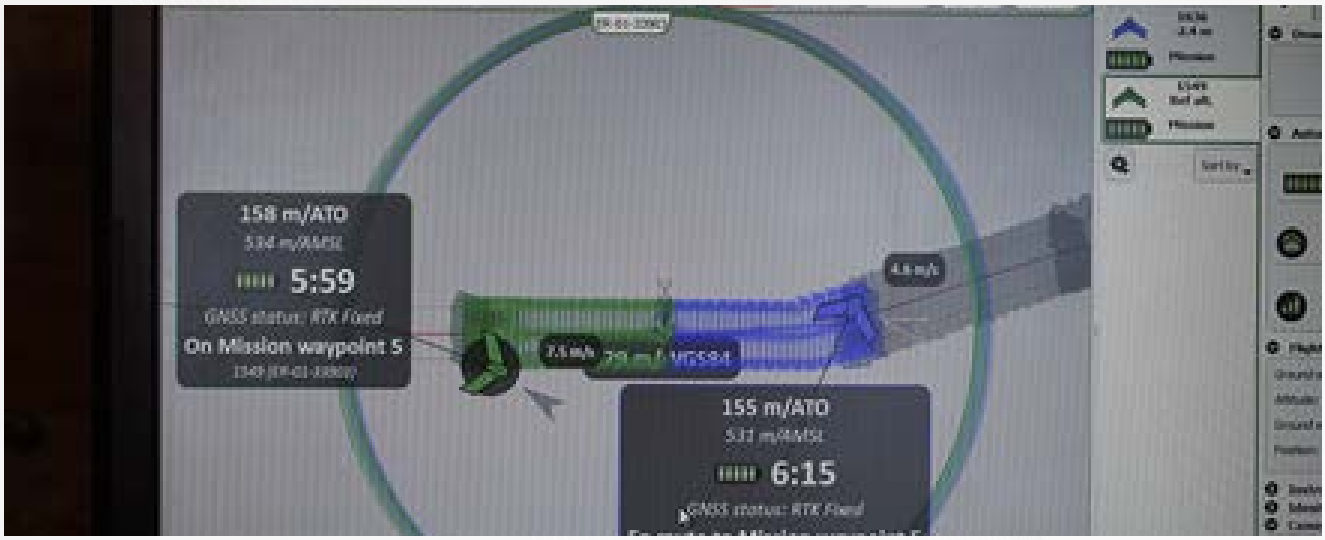
Most of the project's individual flight areas measured 2,000 m long by 400 m wide. This resulted in in 2-3 flights per area, depending on wind strength, flown at approximately 155 m ATO.



Two mapping flights being carried out at either side of the team's base station, managed via eMotion's multiple drone function and spanning a flight area of 3,100 m x 400 m.

Five Survey Group staff worked in the field—flying, processing, camping and generally surviving over a period of three weeks.

The last flight of the day, descending at 17:20.

60% of the five-man Survey Group team (L-R): Matthew Outten (surveyor & pilot), Drew Waters (survey technician & spotter), and Niall Cherry (surveyor & spotter). Not shown: Ben Simpson (chief pilot and project coordinator) and Nathan Robinson (surveyor & pilot).

Team member Drew Waters takes his first bath in weeks at the aptly named Lake Disappointment.