SMALL TOWNS, BIG IDEAS

THE REMOTE TARARUA DISTRICT IN NEW ZEALAND IS AT THE FOREFRONT OF USING SMART CITY TECHNOLOGIES TO HELP ITS CITIZENS. **RACHEL RAYNER** REPORTS

Located in the south-east corner of New Zealand's North Island, the Tararua District is not the first place that comes to mind when talking about 'smart cities'. The district's constellation of tiny towns – total population 17,400 – is spread over 4,360km^2 of rugged farming and forestry land, slotted between the Ruahine mountain range and the Pacific Ocean. Despite its remote location and small population size, the Tararua District Council is a leader in Oceania in its use of technology.

The council is responsible for both the day-to-day management of services such as waste and recycling and bigger-picture planning such as emergency management, transportation systems, water and wastewater – and superfast wireless internet. Blair Rogers, a longtime resident of the region and Master Business Systems' GIS consultant to the Tararua District Council, explains: "The ability to tap into fast broadband capability is the new infrastructure for communities – especially isolated communities." Rogers likens internet connectivity to physical infrastructure such as roads and wastewater pipes: "The council didn't see any difference when providing broadband to the community that wanted it – and farmers are some of the earliest adopters."

The Tararua District has enjoyed superfast wireless broadband for nearly a decade, well ahead of similar centres in the region. This connectivity allows district agencies to use the wireless network to capture telemetry data about water supplies, sewer systems, roads, and bridges. Aerial data is captured with UAVs and used to update the district-wide GIS, capture infrared photos for carbon model analysis, track construction project progress and for large bridge inspections.

"The council is very progressive. Their goal is to untie otherwise isolated data and make it available to the entire organisation and, where possible, to the community," says Rogers.

It's not a tourist attraction, but one of these services and one of the council's biggest assets is the Dannevirke wastewater treatment plant. Aerial photos of the region were previously taken once every five years, with a resolution of 30cm per pixel.

"With UAVs we can get down to 2cm per

pixel. That high level detail is something we want to record over time," says Rogers. "The higher quality images can also be taken more often. Working from data in a photo which is two years old is impossible – you have to retake the images every year so you can look back and compare."

As well as a UAV's eye view of the plant, internet backhaul feeds the data from telemetry monitoring equipment back to the council, allowing a full picture of the plant to build up over time, the better to monitor effluent levels and ensure no runoff reaches the nearby Manawatu River.

Key in realising the value of all this data is the ability to easily and quickly develop and share images. Rogers explains: "This whole project hinges on having good software which produces outputs we can actually make use of and get value from. Pix4Dmapper lets us produce all manner of outputs from highly accurate orthomosaics to 3D models to traditional contour and terrains maps just to name a few.

"We have the ability to process our own data – we don't have to give it to someone else and we can incorporate the data in our workstreams. Typically, we post-process with Pix4Dmapper, upload the data to online publishing platforms and share the data with the council, stakeholders and the community."

UAV data effectively compresses space, allowing the council to have visibility across the region. As well as mapping infrastructure, the imagery is used to map areas of local historical interest, such as the Settler's Cemetery, where townspeople were buried between the 1880s and the 1950s, and to create 3D models for publicity.

More urgently, UAVs are used to capture images of the district's network of rural roads, including storm damage and slips and where streams have scoured their banks to threaten the streets, allowing transport issues to be resolved faster.

"We've had large storms, and culverts blown out 50m under the road level, which

The district has been able to use aerial imagery to plan road developments

means you have to dig out huge volumes to repair the damage. We're using UAV data and Pix4D to show the site when requesting funding for repairs – rather than ask the council to drive out for an hour and a half to view it."

Rogers continues: "This technology is especially important in rural regions because of the distances involved. The distances are vast and the roads and communications are not that great. So, we're seeking to fulfil some essential council functions using data feedback through the internet of things." Infrastructure issues can be made clear with UAVs before they are visible to the council or the average road user. "We couldn't see before that some bridges were flaking. That's critical infrastructure. Building a picture of the lifespan of your equipment and infrastructure and feeding it into your asset management system is key."

The power and potential of these systems for data capture is so high that the council has created a permanent UAV operator position, in addition to engineers who use UAVs as part of their day to day work. The team uses DJI UAVs including the Matrice, Inspire, and Phantom 4 Pro, chosen for their versatility and ease of use. (Rogers also prefers the team use affordable UAVs in remote locations: "If one of them goes in the drink you can easily replace it!")

INTERNET BACKHAUL FEEDS THE DATA FROM TELEMETRY MONITORING EQUIPMENT BACK TO THE COUNCIL, ALLOWING A FULL PICTURE OF THE PLANT TO BUILD UP OVER TIME

Rogers believes UAV imagery and reliable, post-processing software will be most valuable during emergencies and in responding to disasters such as floods or earthquakes.

"If there's a disaster, you can't really expect to have immediate help from elsewhere – help may not be able to get into the region. If something like that were to happen we'd be able to use the knowledge we've gained from this project in a way in which might help our community, with search and rescue or gaining intelligence."

Modelling the smart city

With sensor technology, the Internet of Things, UAVs and software such as Pix4D, mapping has never been more flexible, affordable or accessible. Small cities like the Tararua District are leading the way with agile and inventive uses of the technology, proving that no matter what the size of the town, it can be smart.

Blair Rogers believes that UAVs and mapping software will soon become ubiquitous, "Within a few years, maybe sooner, these devices will be another tool in the toolbox, as relevant as a telephone or total station. The software and the technology is moving so rapidly that if you're not on board with it you'll be left behind."

Despite all the progress which has been made, Rogers emphasises they still have a long way to go as the team maps the smart city. "We're at the beginning of this journey, but we have fantastic plans for the future."

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