Connecting the dots with drone mapping

In the rapidly evolving landscape of drone technology, it is important for businesses, humanitarian organisations and emergency services to be able to keep ahead of the curve. This is where drone mapping and photogrammetry software from CRJ Key Network Partner Pix4D comes in

Working together with organisations to find out what they need from the software, Pix4D puts together the best package for each use case, whether to solve environmental challenges or overcome access issues, to estimate volumes of debris following a devastating wildfire or offer training and support to emergency responders who want to conduct search and rescue (SAR) operations.

In Tanzania, co-operation with WeRobotics (see *CRJ* 12:2, 12:3 and 12:4) has enabled the rapid growth of its Flying Labs, which connect people by providing local knowledge hubs across Africa, Asia and Latin America, delivering a positive impact on local aid, development and environmental solutions. More than 25 Flying Labs are now in action and they serve to enhance the network's expertise in drones, data and AI, while enabling the creation of new jobs and positions, thus supporting local ecosystems. They are interconnected across the globe and this allows for experience and good practice to be shared and for collaboration on joint projects. Pix4D supports this network by providing support and training, as well as its drone-data processing and analysis software programmes, which are reliable and easy to use.

The diverse range of mapping and analysis tools is impressive, but it is Pix4Dreact imaging software that is particularly useful in emergency response and for improving disaster risk management.

Gene Robinson, an expert in how drones are used in SAR, explains that imagery is so important in such operations because there is so much information that video can provide, both for people searching on the ground, and for the co-ordinator. Sometimes, a drone's live feed can locate the missing person while it is still in flight. The rapid collection of data by drones can help to speed up the decision-making processes of the search co-ordinator and therefore increase the chances of success. Robinson says: "With drone imagery, all parties involved know there is a stream, fence, cliff, hill, obstacle or something that will require special equipment or skill. This precludes sending a team out blind and having them encounter said obstacle unprepared." When time is of the essence, such technology proves invaluable.

Pix4Dreact photogrammetry software helps the targets to be located quicker by the operations team because, according to Robinson, it allows distances to be measured quickly and accurately. This provides full situational awareness and confidence by giving what he calls a "minute time" view of the search area.

The software was developed with the help of emergency responders and is designed to be intuitive and simple to use, even for drone or mapping novices. It is also fast. Robinson explains that in the past, his team used Google Earth and the image overlay function to source coordinates and directions, but this was time consuming and not always reliable.

As well as the speed and reliability of the collected data, the orienteering aspect of the software is useful once a map has been created. This enables the SAR operations team to navigate straight to the target, as well as being able to estimate the time it will take to reach it by using the inbuilt tool to measure distances on the map.

Permanent record

The information gathered by Pix4Dreact then becomes a permanent record of the area and of the SAR effort. Robinson concludes: "If anyone needs to review that data at a later date, it is readily accessible in several different formats. If new searches are conducted, it can be used as archival information for the new search party and how the area may have changed since the last search."

This partnership between SAR organisations and Pix4D allows the operations team to have greater confidence of success, because it can access reliable data, which is collated and analysed much faster than by traditional methods.

Another use case where the joint efforts of emergency responders and drone technology come to the fore is in predicting the spread of wildfires.

Although a natural phenomenon, research suggests that wildfires are increasing in their frequency and intensity owing to global climate change. We all know the devastating legacy that is left behind – loss of life, both of human and wildlife, scarring of landscapes and destruction of habitats and homes, not least the fires' own contribution to climate change. So, being able to predict their onset is important.

The Wildfire Aversion by Forecast and Early Response System (Wafers) project team, based at California State University Fullerton in the USA, hopes not only to help the response to ongoing fires, but to provide a proactive assessment of potential imminent blazes. According to the Wafers team leader, Abdulmohsen Aleissa, the current way of predicting wildfires is not good enough because current simulations can take days to run, whereas a fire can cover 60 km in just one day.

Above: *Devastation after the Santa Rosa fire storm in northern California, 2017, surveyed with Pix4Dmapper software*
G Crutsinger | GeoAcuity

Right: *Using Pix4Dreact after a destructive storm*
GlobalMedic

"Wildfires are a research-rich topic," explains Aleissa, "But the current wildfire spread models have limitations. This includes the need for supercomputers, live satellite imagery, and labour-intensive workflows." His project could generate an estimate of the fire spread within a matter of minutes.

The team chose to make its own drone to control the inputs and, as well as collecting both RGB and thermal images, the drone records other data, such as longitude, latitude and slope topography.

The Wafers rotary drones are well-suited for shorter flights over rugged terrain and, despite their shorter flight-time than a fixed-wing drone, rotary drones can take off from anywhere, making them the better choice for such a project.

Back on the ground, the images are uploaded into Pix4Dmapper software and a thermal map is generated to check for hotspots. This map is then fed to the Wafers computer algorithm for evaluation. When a fire is detected, Pix4Dreact makes an orthomosaic map and the algorithm automatically runs the simulation to model the fire's spread pattern over time.

The algorithm can also conduct a what-if analysis, in order to assess a potential fire's damage, even before it takes hold.

And for the first responders on the ground, the Wafers team has made every effort to simplify the process so that stress and time pressures can be reduced and managed more effectively. "The biggest challenge was to minimise the amount of inputs necessary to run the simulation, while still maintaining the accuracy needed to allow firefighters to take decisive action, such as placing fire barriers, or digging trenches around the fires," says Aleissa. Plus, the equipment needed to run project Wafers is as simple as a drone and a laptop.

The icing on the cake is that this algorithm is a low-cost solution, thanks to Pix4D software. Aleissa continues: "Pix4D provides a solution that allows our project to substitute the use of satellite imagery with drone-generated orthomosaics of the wildfire. This allows us to make significant reductions in the budget required to model wildfire spread."

The accuracy of the team's results was verified using data from the Australian Grass Fire experiment. The results mapped closely to the actual fire, which gives hope to the team that its algorithm will be useful to predict future wildfires and help firefighting services mitigate their effects before they escalate out of control.

It is clear from even just these few examples, that collaboration between services and sectors is instrumental in making progress in the fields of public safety and emergency response. Pix4D is certainly helping to connect the dots in this respect. CRJ

Resources

- *Schroeder, A (December 2016):* Social automation, local humanitarians and crisis response, Crisis Response Journal, *12:2*
- *Schroeder, A (April 2017):* Localising robotics for good, Crisis Response Journal, *12:3;*
- *Schroeder, A (August 2017):* Robotics for good: Part III, Crisis Response Journal, *12:4;*
- *blog.werobotics.org/2020/05/06/pix4d-powers-drone-mapping-activities-of-25-flying-labs/*
- *www.pix4d.com*

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