NEW TECHNOLOGIES REQUIRE NEW KNOWLEDGE AND REGULATIONS

UAVs: Where to Focus on Next?

In June 2018, RSPSoc's 'Photogrammetric Record' publication devoted 11 pages to determining which term they would use for drones. They ultimately decided on 'unmanned aircraft system' or 'UAS'. However, the mere fact that this required 11 pages goes some way towards highlighting the complexity and cross-discipline potential that drones bring, not only to the remote sensing industry but also for multiple other uses, writes Peter Kinghan.

Over the past decade we have seen a number of drone uses come through the tried-and-tested period, resulting in unmanned aerial vehicles (UAVs) becoming a proven technology for a range of industries and professions, e.g. aerial photography for construction and surveying, search and rescue (SAR) and agriculture. At one stage, around 2015, significant hype was building in relation to drones, and conferences were popping up everywhere to discuss them. In fact, I remember at one conference hearing of a new drone that could see through concrete walls (perhaps a case of Chinese whispers)! At this time drones were also viewed by some as a hindrance to the aviation industry as they tried to find their place in the skies.

The numbers

In mid-2014 there were just 359 people in the UK permitted to operate drones of up to 20kg. By September 2015 this figure had almost tripled, and by 2019 there were around 5,000 permitted operators in UK airspace. A recent PwC study predicts that there could be 76,000 drones operating in that airspace by 2030. There will also be 628,000 jobs in the drone economy, and the drone industry will contribute to a £42 billion increase in the UK's gross domestic product. So clearly, finding their place – and muscling in on airspace previously restricted for manned aircraft – was only a matter of time.

Surveyors and disrupting technologies

Geomatics surveyors are used to new technologies disrupting their profession. When selective availability was turned off by the US military in 2000, it opened up accurate GPS data for the masses that led to many changes in technology and society. These were particularly interesting for geomatic surveyors, as suddenly knowledge of trigonometry was no longer needed for topographical surveying; you could now survey any point (located outside!) by just pressing a button – on your own, with no need for an assistant to hold a staff. Anyone could do this, no need for a qualification! I'm joking, of course – specialized knowledge was required of level datums, geoid models, coordinate systems, check points and achievable accuracies. In other words, surveyors were still needed! The barrier to entry was far greater back then with a differential GPS costing upwards of €20,000. This barrier to entry doesn't exist for the new drone survey tool, with commercial off-the-shelf (COTS) drones available for a couple of hundred euros and affordable cloud processing options available for photogrammetric software. So now it's cheap and simple enough for anyone to fly a drone – or should I say get a drone to fly itself – after watching a 5-minute YouTube video and to produce a high-resolution 3D point cloud of anything, and even to comply with the relevant regulations in their country. Industry bodies have been quick to update members on the advantages of this new technology and to fund research to assess related pitfalls and recommend preferred data collection methodologies. This has all aided the uptake of drones by surveyors. But what about the integrity and accuracy of the data? That's crucial for those in the geospatial industry and those relying on geospatial data.

Using drones for baseline environmental studies for a proposed hydro dam project in the country of Georgia.

The drone is just a device

For me, as a mineral and geomatics surveyor and environmental consultant, it was never about the drone, but about the high-resolution and high-accuracy 3D photogrammetric model. In the 2000s I surveyed many a quarry and construction site on foot using GPS systems or a total station – carrying survey equipment close to high quarry faces and large plant and machinery never really felt safe. Then along came the eBee fixed-wing drone, with Pix4D's structure from motion (SfM) photogrammetry software. More recently, drones with Lidar have become available, increasing the number of sites that can now be flown, e.g. forestry and vegetated areas. I haven't surveyed a site on foot in over five years! And I am now using far richer and more useful survey data that has been collected with me out of harm's way – with the added bonus of saving time as well. That's not to say that flying a drone has been entirely safe. I've had my share of incidents and have hit at least one tree, one fence post and also managed to 'land' a drone in a tree in a remote mountainous area outside a cave in a country known for its bears, wolves and wildcat population!

Expertise required

As with all new technologies there is a skills shortage, and some survey data is being produced by drone pilots without a survey qualification. And it's not just point clouds that drone pilots can produce – they have their pick of new careers, with the ability to fly a drone opening up a range of options for pilots. These are linked to the payload that the drone can carry – be it a camera for topographical survey data, multispectral sensor for assessing vegetation health (useful for farmers) or thermal sensors for asset inspection and search & rescue (SAR). But all these technologies require expertise knowledge, and in some cases ground truthing and standardized methodologies for data collection.

3D point cloud resulting from a UAV photogrammetry cell tower inspection project. (Courtesy: Pix4D)

Drone monopoly

In the past decade, Chinese company DJI has succeeded in building a drone monopoly with its high innovation, fast pace and low-cost manufacturing, flooding the world markets with affordable, reliable and technically advanced drone products. Drone manufacturing companies in more developed countries could not compete with DJI and most have either ceased trading or retrenched. A change to their fortunes may have recently commenced with the US military recently issuing a direction that DJI products can no longer be used due to cybersecurity concerns. This once again opens the door for domestic drone manufacturers in the USA.

The current drone technology is really impressive and it is hard to see how it can be greatly improved, except for increased flying time and more affordable high-accuracy GNSS options. Having said that, keeping a drone in the air for over an hour requires diligence and concentration, so the current battery power and flight time limits might be just right!

Regulations and standards

Due to the pace of technological advancements, regulators and standards bodies in the drone industry have had to take the 'follow, not lead' approach. The key question for regulators and standards bodies is what to focus on next. There is plenty of low-hanging fruit – some ripe for picking and some a couple of decades away from fruition! Some examples include:

1. Using a drone and SfM photogrammetric software to produce a digital twin of a working wind turbine that can then be used by an engineer to inspect the structure for damage. The wind turbine market is growing and the production of a digital twin is a proven survey method. However, my methodology in producing the photogrammetric model and the model parameters – e.g. resolution, accuracy, etc. – will be different to the next person's, so we need a standard to define the data collection and data processing methods.

2. Urban air mobility: this is the term of the moment, as a number of big companies (Airbus, Boeing) are developing passenger-carrying drones. These are electric vehicles with vertical takeoff and landing capabilities (eVTOLs) – similar to helicopters, but not as loud and not as expensive to run. 2023 has been suggested as the year we can expect to see autonomous passenger-carrying drones in some cities. Testing and certifying these systems may take a bit longer, however. In fact, realistically, they will need to be manned as it will be hard to achieve public acceptance for autonomous aircraft over and within cities. Especially considering the recent negative experiences of testing driverless cars (with a human behind the virtual wheel), that could be a difficult challenge! There are lots of stakeholders – from fast-moving entrepreneurs to the more cautious regulators – all of which will need careful management. Not to mention the work required to align current city zoning and address privacy concerns along with the infrastructure, policy and regulatory deficits. And there will be a requirement for accurate up-to-date 3D models of cities – so work here for us surveyors.

3. Orthoimagery and image-based point cloud data. Similar to when producing a digital twin, drone pilots (or surveyors with drones) will determine their own methodology for data capture based on a number of considerations, e.g. survey requirements, weather on the day of the flight, type of platform, etc. The flight parameters, and associated survey methods, with the type of equipment being used and the processing software being employed will influence the accuracy of the data produced. The expertise of the data collector will also have a part to play. Guidance for practitioners is required to ensure reliable and usable survey data is produced.

UAVs equipped with next-generation technology for autonomous inspection of wind-turbine rotor blades. (Courtesy: Sulzer & Schmid Laboratories AG).

What next?

So now that the hype is settling down and we've realized that drones can't see through walls, what will happen next? There are enough proven advantages of using drones for ongoing required tasks that will ensure they are here to stay, and enough potential uses for people to continue investing in research. For example, the recent bush fires in Australia have started a new conversation about drone usage for firefighting.

Flying a drone can be nerve-racking and also fun, but it's never been about the drone – to survive in today's world requires finding ways to do business more efficiently, more safely and with a higher-quality end result. Drones have helped the survey, construction and agricultural industries tick all these boxes, and drones can help lots of other professions and industries. Collaboration and innovation are required to ensure drones continue to reach their potential in improving lives and society.

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