By **Peter Wilder**

# Welcome to the drones club

Drones will revolutionise the way in which we gather and process data about our environment, but anybody thinking of using them needs to be properly trained and licenced.

**1** – The Delamore Estate in Devonshire, surveyed by Peter Wilder's company. © Survey Drone

As landscape architects we are used to viewing the world from above, be it looking at topographical maps, aerial photos or masterplans. Until the advent of Google Earth and the explosion of site information available on the internet, information was a precious commodity, jealously guarded by the few that had access to it.

The proliferation of drones or UAV (unmanned aerial vehicle) technology is set to revolutionise the way in which we gather and process data about our environment. Whereas Google Earth can provide aerial images that are updated with ever increasing frequency, drones can capture highly accurate and low-level data in the space of a few hours. But far more than just an aerial photography platform, drones are now able to perform tasks that have up until now required expensive satellite or LIDAR (light detection and ranging) imagery from aircraft.

Fixed-wing drones have long been employed in agriculture for the survey of crop health and have also been used widely in land survey. Although drones are capable of covering vast areas autonomously, the greatest restriction on their flight range at present comes from CAA (Civil Aviation Authority) guidelines stipulating that even autonomous flights must be conducted within the visual line of sight (VLOS) of an authorised pilot. Special licenses have been granted to certain operators, particularly those operating over private land, to fly beyond visual line of sight (BVLOS) to capture even greater amounts of data with drones that have extended range.

Multi-rotor aircraft have proved to be the most successful platform for aerial capture as they offer vertical take-off and landing (VTOL) as well as high-speed flight. Whilst quadcopters are often associated with hobby operators, they have also become a key component on film sets. The market now offers sophisticated aircraft with multitudes of technology for remote sensing, and high-definition cameras for both still and video capture. So how does this all fit into the landscape profession and how will it change the way that projects are delivered?

Built-environment professionals now have the ability to capture highly accurate aerial images, with embedded GPS data to 13 decimal places and altitude data to the nearest centimetre, which can be assembled into data sets called point clouds. This is where corresponding points from adjacent images are matched and merged into collection of coherent co-ordinates to create a 3D entity. This information can then be assembled into a digital model over which aerial images are mapped. The applications for such data are almost endless. The civil-engineering professional can create a geo-referenced 3D site model in a fraction of the time and cost of a topographical survey in order to carry out preliminary site assessment for issues such as flood risk, topography, and site vegetation. This data can also be loaded into civil-engineering software such as AutoCAD Civil 3D or Revit in order to undertake more complex modelling such as cut-and-fill assessment or gradient analysis.

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We are currently using our UAV in LVIA assessment in order to construct 3D virtual landscapes that enable the site to be viewed from various angles and the ability to reconstruct views. It doesn't yet replace a DSLR (digital single-lens reflex camera) with a 50mm lens but it does prove useful in establishing accurate height and position of our camera when plotting viewpoints. Some of our clients now expect us to present our site assessment internally and at planning meetings as a virtual model that members can manipulate in order to discuss certain points of the site or the concept. The site information can even be uploaded to the internet or to a cloud-based server so that it can be used to inform overseas investors' decision on the purchase of a site.

We are now looking into the application of point-cloud data in comparing site volumes for a client who is a landfill operator so that we can assess gate receipts against volume, but it could also be applied to site capacity assessment during purchase negotiations over a site, since volume equals revenue.

Many of our architectural clients are excited by the possibility of introducing thermal cameras in order to construct 3D thermal envelope maps of their buildings either pre-refurbishment or in post-construction evaluation. But thermal imaging opens up other opportunities such as inspection of solar panels, detection of leaks in waterproofing membranes and even carrying out deer herd

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**2** – DJI Inspire 1 drone. © DJI

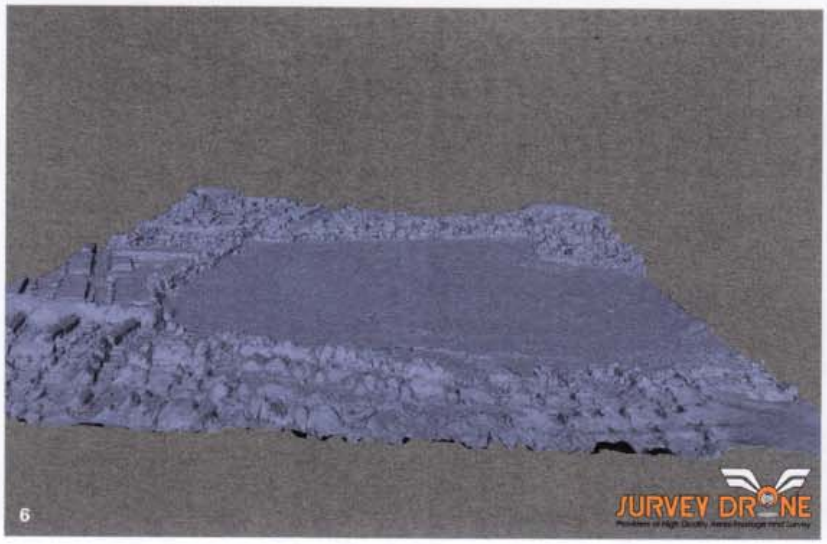
**3** – Peter Wilder giving a demonstration at the University of Greenwich. © Survey Drone

**4** – Survey Drone surveyed Chestfield in Kent as part of a planning exercise. © Survey Drone

**5** – Image of a site survey, including the point cloud. © Survey Drone

**6** – The sort of terrain model that can be built up from a drone survey. © Survey Drone






counts in Scotland. Many police and fire services are now using drones in search and rescue operations or in fire detection, thanks to the ability to be in the air quickly and the fact that the equipment can be carried in any vehicle to the incident.

The tipping point in our decision to invest in a commercial drone was the advent of DJI's Inspire 1 in 2014. A mid-range drone with a flight time of 22 minutes and a top speed of 50mph, it broke the boundaries of high-end capability for under £5000. Since its emergence it has become a feature on many film and aerial photography shoots due to its ability to carry a variety of camera types including thermal and micro four-thirds formats. Our decision to set up a separate company was also the right one as it enables us to operate as a sub-consultant to other landscape and architectural firms without a conflict of interest. But the real opportunity for drone operation is the ability to get involved with a site right at the outset and to work with a client on the assessment and early evolution of the masterplan.

The software required for processing imagery into point-cloud maps or digital terrain models can be very expensive. with popular platforms such as PIX4D and Agisoft

Photoscan costing up to £6,000. Those processes are now being challenged by new approaches such as Drone Deploy where mission planning and photography is automated and the images uploaded to the cloud to be processed. Once processing has been carried out, the finished virtual model can be downloaded from the cloud server for a fee. The service is paid for on a site by site basis depending on the size and number of images that require processing. This not only saves on the purchase of software but also on the purchase of the serious processing power required to produce the millions of calculations required to calculate the geometry.

It seems that the only things standing in the way of the adoption of drones at present are the perception of the risk that they pose to aircraft and the fear of invasion of privacy. There are strict guidelines in place for use of drones. Operators must obtain a Permission for Aerial Work (PFAW) from the CAA in order to carry out commercial work and obtain public liability and professional indemnity insurance. The CAA only grants permission to operators who have passed an accredited theory course, a flight test involving site evaluation and emergency procedures, and have had an operations manual approved. There are strict limits on ceiling heights (currently 400ft or 121m) and minimum distances from people and vehicles. On top of this there are also restricted air spaces in major cities including all airports, prisons and military installations.

**7** – A drone was used for this music video shoot. © Survey Drone

**8** – A green footprint near Stonehenge. © Survey Drone

We see drones or UAVs as a logical extension to the work that we already carry out in digital terrain modelling and surface-water management for large-scale civil engineering or masterplanning projects. This year I introduced aerial mapping as part of the curriculum at the University of Greenwich. Having been around long enough to see the transition of cut and fill modelling from the drawing board to the computer, it is only a logical step to see the survey and aerial capture technology become a part of the site analysis process.

**Peter Wilder** is director of Wilder Associates and Survey-Drone Ltd and a BRE Associate. He is a CAA licensed UAV pilot and a member of the Association for Remote Piloted Aircraft Systems. He also teaches digital terrain modelling, sustainable drainage and hydrology principles at the University of Greenwich in his spare time.

### Drone Facts

Technically speaking, a drone is any aircraft that has the ability to fly autonomously and without a pilot. Not all multi-rotor craft have the technology to fly autonomously and CAA guidelines stipulate that even when operating autonomously a qualified pilot must have the ability to take manual control at all times.

Although commonly referred to as drones the preferred terminologies are defined below.

**RPAS** – Remoted Piloted Aircraft Systems

**UAV** – Unmanned Aerial Vehicle

**SUAS** – Small Unmanned Aerial System

As of 20 May 2016, there were 1769 CAA approved commercial Small Unmanned Aircraft (SUA) operators.

There are several National Qualified Entities (NQE) to offer training in UAV operations including EuroUSC and RUSTA (Rheinmetal Unmanned Systems Training Academy).