



The View from Above

By Mike Calnan

Cutting-edge drone technology is being brought into service to aid in the surveying and conservation of historic landscapes.

Small unmanned aerial vehicles (UAVs), commonly known as drones, are being rapidly integrated into our daily lives in ways we could never have imagined even a few years ago. From delivering medicines to remote rural communities to airborne forest reseedling and creating dramatic aerial footage on TV, drones are becoming central to our technological age.

The wider conservation sector has been quick to adopt the time-saving and unique opportunities that drone aerial imagery can offer, ranging as they do from mapping wildlife habitats and archaeological sites, to recording landscape changes and carrying out close-range surveys of historic structures. Uptake in the world of historic gardens has been more limited, perhaps because the value offered by drone technology is not always self-evident. In fact, it opens exciting possibilities for owners and managers who wish to record, monitor, survey or promote their sites.

Put simply, drones are a way of getting a camera airborne to capture new perspectives on familiar places. They are faster to deploy, less complex and cheaper to operate than conventional aircraft and, what is more, can be used to obtain dramatic low-altitude images in closer proximity to structures, trees and other features in the landscape. An onboard GPS/flight system combined with external software makes drone flying easier, if not automated, streamlining image and data capture and processing.

But we must not forget that safety is the paramount consideration when it comes to drones. The larger models can weigh ten kilos (1st 8lb) or more and are equipped with up to eight sets of propellers, spinning at 8,000rpm. In the wrong hands they are extremely lethal weapons!

For historic garden owners drones provide two main opportunities: firstly for publicity and interpretation and secondly as a tool for research, inspection, monitoring, mapping and planning.

People probably associate drones with video footage, which has become ubiquitous in film and on television. Drones can certainly capture dramatic footage and the viewers' attention in a way other media can't. The National Trust realised the potential benefit of this during the UK's 2016 Capability Brown Tercentenary Festival, by giving on-line visitors a chance to see his landscapes in their entirety. For many, it was a unique opportunity to appreciate Brown's designs as he may have envisaged them in his mind's eye.

Museum and historic house and garden websites frequently incorporate 180- and 360- degree panoramas created using drone photography. These low-altitude aerial perspectives provide a 21st-century take on the popular bird's eye views recorded by artists for their patrons centuries

Above: A rare survivor Dutch-style water garden at Westbury Court in Gloucestershire. Photo: National Trust, Chris Lacy/Mike Calnan.



Above: Herrenhausen Gardens in Germany provide an example of the interpretative use of on-line panorama images. Here, digital flags link to additional images and information.

before, and open up a new approach to site interpretation and promotion. Johannes Kip would approve!

Drone stills photography is increasingly seen on historic house and garden websites and in related books, guidebooks and on-site displays. These can be extremely effective in revealing a garden's scale, setting and design features and for capturing transient changes in the landscape for social media and other uses. A good example of this are parch marks, which appear in especially dry summers and reveal the outlines of what had been there in the past – flower beds, for instance. Drones are also useful for before and after comparisons of major restorations or for recording seasonal changes via time-lapse sequences, as well as repeatable fixed point photo monitoring of tree growth following major storms, or deer herd head counts in parkland.

Drones provide cost-effective solutions for surveys and inspections of historic structures, particularly inaccessible roofs and tall garden buildings or monuments, where the cost of regular erection of scaffolding would otherwise be prohibitive. Where a structure is unsafe, as was the case following a devastating fire at Clandon Park, Surrey, in 2015, a drone can rapidly be deployed to provide images that would otherwise be impossible to obtain, allowing

conservators and other experts to assess the situation accurately and safely.

Drone technology is



Left: Orthomosaic-derived 3D digital model of Blaise Castle, Bristol. Photo: Above Horizon Photography.



Above: A large, two-man operated, eight-rotor drone with high resolution camera pictured at the National Trust's Dyrham Park in Gloucestershire.

evolving rapidly. Pre-programmed flights are now possible, enabling repeatable, fixed-point photography, opening up new research and interpretation possibilities. And lightweight, drone-compatible multi-spectral sensors can reveal information about vegetation and terrain, such as moisture content and plant health.

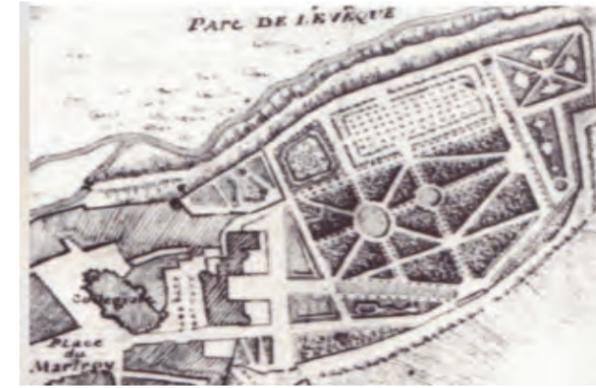
Photogrammetry is a common technique for processing aerial imagery (including from a drone/UAV), using overlapping photos to create high-resolution geo-referenced maps (orthomosaics) and 3D visualisations. Examining these on a computer, it's possible to zoom in to see individual areas or features at far higher resolution than with satellite images, as well as viewing the terrain in 3D, which can be useful for archaeological surveys.

Being very accurate down to 1cm (1/8in), orthomosaic maps can be used as an alternative to ground-based surveys, for example to plan developments by superimposing other forms of data.

Aligning historic imagery alongside the relevant part of an orthomosaic map can help illustrate how a garden has changed over time. Using this method, parkland trees can also be accurately, quickly and relatively cheaply plotted for both management and interpretation purposes.

Hopefully, the next big breakthrough will be plant health surveys using drones. Thermal imaging and multi-spectral cameras are already being used across the world to detect plant growth differences, for example within commercial farm crops, or tree diseases, such as Ash Die Back or Chestnut Blight within mono-crop forests.

The wide range of tree species found in gardens and arboreta is generally too great to draw meaningful conclusions from such surveys at present but, given the speed at which this technology is developing, it probably



won't be long before drone tree monitoring and the early detection of garden tree health issues becomes possible. This will save time and costs and improve safety in deploying arboricultural specialists to undertake closer, more detailed inspections.

One of the most exciting and potentially game-changing aerial surveying techniques is drone-based Light Detection and Ranging, known as LIDAR. This uses light, in the form of a pulsed laser, to measure small height differences in 3D. LIDAR can capture features on the ground that would

Left: Scanning through a woodland canopy, a drone LIDAR survey was able to detect traces of the lost 18th-century garden at Château de Meung-sur-Loire, France. A resin model produced from the survey is now helping visually impaired visitors to sense the lost garden through touch. Photos: AIRD'ECO-Drone <https://www.airdeco-drone.com/en>.

otherwise be difficult, even impossible, to detect in any other way. For example, by digitally removing all above-ground data such as trees and buildings, a LIDAR survey can reveal subtle ground features, even through a thick canopy of trees. The resulting 3D images can be used to identify archaeology or patterns in the landscape that would otherwise be invisible or difficult to appreciate at ground level. This helps in pinpointing where follow-up investigations or digs could be worthwhile prior to developing a restoration plan.

We are living at a time when historic gardens are under increasing threat from visitor pressure, new devastating pests and diseases and extreme weather patterns, so having access to this technology to aid in their conservation is a welcome development. At the same time, drone technology is also helping to bring the past to life in imaginative and new ways that enhance our understanding and enjoyment of these places. We are just at the beginning of this aerial revolution but, even in its present form, drone technology offers many exciting, cost-saving and game-changing opportunities to help us care for the past to ultimately benefit future generations. Onwards and upwards! 🌱

Mike Calnan was Head of Gardens, National Trust, from 1999-2019 and is now Director of Topographica drone filming and photography: <https://www.topographica.co.uk>.

SAFETY FIRST

Anyone contemplating hiring a drone operator in the UK (different rules apply in other countries) should only engage Civil Aviation Authority (CAA) approved operators, who have undergone rigorous approved flight training and ground school. Operators must have this CAA 'permission' (renewed annually), plus a minimum of £1m third-party liability insurance and often aviation insurance on top. There are over 4,000 operators in the UK at present, specialising in everything from aerial surveying and filming to photography.

Anyone hiring a drone operator is advised to make themselves aware of the Drone Code which sets out the flight limitations under which a hired operator will work, as determined by UK Air Law. https://dronesafe.uk/wp-content/uploads/2019/11/Drone-Code_October2019.pdf