

In days of yore - and not so many of them at that - the job of the surveyor was well-known to be a perfect misery of tape-measures, theodolites and many laborious hours spent poring over drawing boards. No longer. The modern surveyor, it appears, simply stands, twiddling the joysticks controlling a drone, while it flies around taking photographs. These are relayed to a computer and out of the back of this, as it were, emerges an inch-perfect contoured survey of everything the drone has seen.

How can this be? Jamie Quartermaine, a project manager with Oxford Archaeology North held the close attention of a spellbound audience at Appleby Archaeology's December meeting in the Supper Room of the Appleby Market Hall while he explained.

The answer, it seems, is a technique known as **photogrammetry**. The concept, we were informed, was known to Leonardo da Vinci and has been used to produce Ordnance Survey maps since the Second World. Essentially it is a trigonometric technique that can be used to analyse two photographs of an object taken from different positions and thereby establish the three-dimensional coordinates of points on the surface of the object. What has changed is firstly the availability of GPS to accurately measure both the location of the camera and fixed points on the object and secondly the ready availability of the massive amounts of computer power required to perform the mind-bogglingly complex calculations that turn picture into map. Allied with user-friendly software, high-quality cameras, drones and GPS devices at modest prices a package emerges that has quite remarkable potential for use across an enormous range of applications.

Jamie has worked as a landscape and building surveyor for over 30 years and so has seen these developments at first hand. He described how he was able to produce a centimetre-perfect contoured survey of the surface workings at Greenside Mine - almost a square kilometre of extremely rough ground at an average elevation of 400m - in just a few days. An "interpretative" phase is required, wherein a skilled individual will highlight and label features of interest on the computer-generated map, but otherwise the whole process, once the initial photographs have been captured, is totally automatic.

However, this is not the end of the story. Because the survey is now captured as a "digital model" it can now be processed in various ways to facilitate interpretation. For example, the vertical axis can be exaggerated to reveal subtle ground features. Digital "lighting" can also be introduced to simulate shading to highlight the ditches and banks on an archaeological survey. Plans and sections of the surface can be extracted. Finally, texture can be added, using the original photographs as a guide, enabling an "observer" to "fly" around a fully-realised model of the surface.

Photogrammetry works at any scale - the technique is equally effective on the recording of a landscape, a building or an artefact. Where a landform is obscured by surface vegetation or forestry, conventional optical photography can be replaced by a laser imaging technique known as Lidar.

Interior surveys of buildings pose special problems because, of course, a GPS signal is not available in such situations. However within just the last few years, hand-held laser-scanners employing inertial positioning (the same technology that is used to guide space vehicles) have appeared that enable the surveyor to produce an accurate model of the interior surface of a room simply by walking through it. Once again Jamie described personal experience of this technique having produced an accurate floor plan for a 240-room 6 story factory in just 2 days.

What can be achieved with all this information? Well, one member described how photogrammetric records of a building undergoing renovation had been so accurate that they had been used to provide cutting lists for the new stone required to replace damaged blocks. In Appleby, now a Heritage Action Zone, detailed recording of its many fine buildings will be required to guide conservation and restoration plans. It seems that Appleby will, quite literally, be buzzing before long.

The next meeting of Appleby Archaeology will be its AGM and Members Evening on Thursday the 11th of January