

Low-cost long-range mapping

Unmanned aerial vehicles (UAVs) are providing simple, low-cost methods for collecting detailed data and high-resolution photography that allows for enhanced geological mapping, says **Adrian Charters**

In the March 2011 issue of *Quarry Management*, A P Wilkinson of QuarryDesign wrote an article on the 'hands-off' approach adopted for geological and geotechnical mapping using long-range high-definition LiDAR surveying equipment.

Since 2011, technical advances in unmanned aerial vehicles (UAV's) have allowed the remote collection of data from the air, but most recently it has been integrated with long-range high-definition radar, LiDAR, for enhanced geological mapping.

The aerial collection of data compliments the ground based LiDAR data and maintains QuarryDesign's ethos of obtaining survey, geological and geotechnical data in a remote manner. Land & Minerals Consulting (L&M) QuarryDesign has created this "hands-off" approach and the integration of both terrestrial LiDAR and UAV derived data was recognised by the Mineral Products Association in their 2013 annual Safety Awards where they bestowed a runners up award in their engineering category.

Until the development of LiDAR and more recently commercial UAV systems, the collection of some survey, geological and geotechnical data has been difficult to obtain safely and quickly.

This article paper outlines the training, legislation, UAV types, payloads and flight planning methodology required for operating UAV's, and data processing for 3D terrain modelling and topo surveys. Specific site examples show how safe, remote, data collection survey methods can be carried out without the need for personnel to be exposed to safety hazards.

Commercialisation of UAVs

Research in UAV technology has been increasing since the late 1980s. Initially, the applications for this technology have been centred on military usage and were generally outside the commercial sector. The main reason for this is that military UAVs generally operate outside of civilian airspace and do not have to comply with civil airspace standards and rules.

Traditionally, the use of photogrammetric techniques to carry out ground surveys of large greenfield or existing quarry areas is well established and has been obtained by the



Low altitude photography provides survey detail

use of manned light aircraft. However, this method of flying at low altitudes and air speeds to obtain high resolution photography for detailed surveys comes with inherent risks and not to mention significant costs. UAVs offer are far cheaper to run, easy to launch, relocate and refuel/recharge.

Also, in today's increased environmental awareness, a UAV's environmental footprint is significantly less in terms of material requirements and pollution than piloted aircraft. Recent technological developments in the miniaturisation of on board GPS, battery technology, lightweight brushless motors and smaller format high resolution cameras have led to an explosion of commercial UAV systems for being made available to a wide range of sectors including

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agriculture, forestry, policing, civil engineering and mining and quarrying.

A quick search of YouTube will show that the use of UAV systems is widespread in the civilian population. The relative low cost and simplicity of UAV design has resulted in a flood of vastly different models into the air space. Not every aircraft is built to a rigorous level of safety and often operators are untrained fliers, a serious issue when you consider these aircraft share the same airspace as manned and passenger aircraft.

However, the requirement by the UK Civil Aviation Authority (CAA) to obtain a 'Permission for Aerial Work' when flying commercially, requires operators to register and train with EuroUSC to obtain a Basic National UAS Certificate (BNUC). This qualification certifies the UAV airframe airworthiness and that the pilot has achieved a level of competency recognised by the CAA.

The majority of small UAVs used commercially in the UK are flown on a BNUC-s (small) Certificate for fixed wing and rotary vehicles with less than a 20kg maximum takeoff weight.

EuroUSC training

Currently, the EuroUSC training is recognised in the UK and its territorial dependencies of the Republic of Ireland, Spain, Netherlands, Belgium & Hong Kong and is being rolled out to the rest of the EU.

The BNUC-s Certificate allows an operator to fly to a maximum height of 120m and up to 500m laterally from the pilot location. For missions over 500m, a second pilot is needed and an additional Extended Visual Line of Sight (EVLOS) Certificate is required. Although it is a grey area under CAA rules, it is accepted that the use of photographic UAV systems require the permission of the landowners being over flown. As with all equipment, by selecting the right UAV for the task, UAVs can remotely obtain valuable video and photographic data which can be used to perform remote face inspections.

Vital geographical, geological and geotechnical data can be obtained from the resultant 3D models. ■

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