UAS Around the World

As editor of this special issue of *GIM International* I am delighted that the success of the first edition dedicated to UAS, published in 2013, has resulted in this follow-up issue. Unmanned aerial systems have been operational for regular geodata collection for some time now. One example is the weekly capture of a nuclear power plant construction site in the UK using a fixed wing – wingspan 100cm; weight 2kg – as reported in the first UAS special

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edition. Here, on page 19, Romersa and Küng present the use of the senseFly eBee fixed wing, equipped with a customised 16MP Canon Ixus 125HS camera, for creating a digital surface model (DSM) of the world's biggest open-pit copper mine. From time series of aerial images of the mine, located in the Andes of Northern Chile, DSMs with a ground sample distance (GSD) of 14cm are created for calculating the volume of ore extraction. The accuracy is similar to terrestrial laser scanning (TLS), which has proven to be the best tool for surveying sites where access is limited due to safety constraints or harsh conditions. But the use of TLS is more costly and time consuming than UAS. Fixed wings are well suited to operating in windy areas where the air is full of dust and temperatures are low. With a wingspan of 96cm, the eBee can endure strong breezes and the rear-mounted propeller further improves safety. The foam frame results in a weight of just 700 grams, enabling it to be launched by hand and to stay in the air for 45 minutes. It automatically returns to the take-off point and lands autonomously if the battery level is low or the wind is too strong. The system comes with eMotion 2 flight planning and control software and Postflight Terra 3D-EB photogrammetric software, specially developed for eBee images.

MERGING

A lot of testing is still going on to obtain insight into how UAS can be an alternative to geodata collection techniques in use today. Franken (see page 23) investigated the aptness of a multicopter to replace airborne Lidar, which is the current method for mapping breakwaters along the North Sea coastline, since Lidar is costly for small project areas. The UAS survey resulted in a height accuracy of the DSM – density 100 points per m^2 – of 11mm. This article also shows another advance: merging of UAS data with other geodata. Here the DSM, created from UAS imagery, and bathymetric depths collected by a multibeam echosounder operated from a vessel have been merged to create one seamless DSM. On page 26 Fiermann and co-authors present a tandem system consisting of a copter and a ground robot for autonomous inspection to support surveillance staff, repair servicemen operating in harsh conditions and many others.

REMOTE AND HARSH

To demonstrate suitability in remote and harsh environments, researchers do not flinch at the thought of travelling to our planet's extremes. In a 2014 paper published in the *International Journal of Applied Earth Observation and Geoinformatio*n (27 Part A, 53-62), researchers from Tasmania report on capturing the micro-topography of moss beds in East Antarctica using a MikroKopter OktoKopter, payload 1.5kg, equipped with a Canon 550D digital SLR 18MP camera. Each of the 200 images, 1cm GSD and collected during one flight on 24 February 2011, covered an area of 64m by 43m. A total of 42 ground control points (GCPs) were measured with a Leica 1200 DGPS receiver, accuracy 2-4cm; 12 GCPs were used for georeferencing and 30 for accuracy assessment. Although the autopilot failed due to magnetic declination which forced manual piloting, a 2cm DSM and a 1cm orthomosaic of a one-hectare area could be created, both with 4cm accuracy. If unmanned aerial systems can operate successfully in the Andes and Antarctica, they can operate anywhere in the world – no matter how remote the environment and how harsh the conditions. However, legislation may still be a snag.