

Mapping Unplanned Settlements using Unmanned Aerial Vehicles (UAVs)

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Photogrammetry is the science of making measurements from photographs. The technology has been in existence for more than a century, gradually developing over the years and now ripened into maturity, meaning that today reliable, accurate and detailed features of the earth's surface can easily be acquired as and when required using ordinary digital cameras fixed to a remote controlled model aircraft, unmanned aerial vehicle (UAV). First, the basics: In Aerial Photogrammetry the camera is mounted in an aircraft pointing vertically towards the ground. Multiple overlapping photos of the ground are taken as the aircraft flies along a flight path. These photos are processed in a stereo-plotter (an instrument that lets an operator see two photos at once in a stereo view) thereby making possible the production of a composite aerial imagery of the real-world. To be of further use for most urban applications, the airborne imagery needs to be geo-referenced. The conventional way of geo-referencing images is by using Ground Control points (GCPs). These are reference points (minimum four) which must be accurately measured on the ground.

Project Area

How can aerial photogrammetry be applied today in managing fast growing cities? In answer we can look at a recent pilot project aimed at mapping unplanned settlements using UAVs in the City of Ndola. Ndola is the third largest city of Zambia with nearly 15% of its half a million population residing in unplanned settlements that lack basic municipal services such as access roads, safe drinking water and sanitation. As a pre-condition for central government to officially recognize an unplanned settlement, a local authority is required by law to produce Area Improvement Plans (AIPs) which should clearly show proposed and existing roads (if any), and the location of each building identified by a serial number. The project was realized through a collaborative effort between Ndola City Council and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) under its programme component on Sustainable Local Finance

Management in South East Africa. Dr. Hans-Peter Thamm, who is a respected expert in this field with many years of experience, was head of the mission.

Results

In the month of May, 2014, close to 1000 photos - covering 12 unplanned settlements - were taken at a flying height of 80m using a Nikon digital camera guided by a battery powered UAV (Modified Phantom II Quadcopter). Using powerful photogrammetric processing software, the results were very good ground resolution orthophotos of the areas of interest (AOIs).

Low cost in comparison with classical aerial photogrammetry and the high flexibility that allows its use in environments and at altitudes almost impossible for manned aircrafts represent obvious advantages of this system. Very high image resolution (close to 10cm) is another incentive to consider UAVs.

UCLG Africa Comment

The UCLG Africa partners with Slum Dwellers International (SDI) in promoting collaboration and improved relations between cities and slum dwellers in Africa under a programme known as the 'Know Your City'. The programme achieves this aim through engaging the city and slum dwellers in a process of self-enumeration, profiling and mapping of slum settlements with the objective to improve cohesion among all the inhabitants of the city and provide reliable data for planning in order to effectively address the challenges posed by these settlements especially regarding the provision of basic services and security of tenure.

This article is intended to share the experiences reported for the information of our members.