

# **Virtual Surveying: Mapping and Modeling Cadastral Boundaries Using Unmanned Aerial Systems (UAS)**

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## **SUMMARY**

The fusion of positional, navigational and imaging technologies and the ability to mount these on unmanned aerial vehicles (UAVs) has opened up new opportunities for local mapping and monitoring in support of land administration. In this paper we describe a pilot test undertaken in Albania to develop a UAV-based approach for cadastral mapping to support land registration and improve existing cadastral records. This work was funded through a World Bank innovation grant within the ECA Region. In this paper we focus on the legal function of a cadastral map within the particular context of Albania. Like many other countries in the ECE in the early 1990s, Albania embarked on an ambitious land privatization program to support the conversion of state farms and cooperatives to private marketable properties. Over the ten year period from 1995 to 2005 first registration was completed in approximately 2000 of the 3200 cadastral zones in the country. This registration is based on paper maps of questionable quality and which are not connected to the national coordinate system. The poor quality of these maps has hindered land acquisition for infrastructure investments as well as the on-going legalization of informal settlements, restitution/compensation and functioning of the land market. In addition, these paper cadastral maps are degrading from the wear and tear of routine use and there are no backup copies to protect against fire or other damages that might occur. As a result, the very tenure security that these cadastral maps are designed to support is being undermined. The World Bank-funded Land Administration and Management Project (LAMP) begun in 2007 is specifically designed to “improve the efficiency and effectiveness of land administration and management through enhanced tenure security and improved urban planning.” The UAV approach described in this paper is designed to facilitate this project goal. A UAV approach provides high resolution, up-to-date aerial imagery and offers a means of resolving boundary issues in focal areas. Because 3-D geo-referenced spatial models can easily be derived from UAV imagery, this approach can also provide the control to integrate and improve the quality of existing maps. The paper will describe how this was done in Albania to improve the spatial quality of existing cadastral maps. The UAV methodology will be described in three stages: mobilization (acquisition, assembly and testing of the UAV), field work (reconnaissance, ground control, flight planning in Albania, image acquisition), and post-processing of imagery (photogrammetry, quality assessment, production of 3-D models). We will also discuss issues and problems that arose in the field testing of this methodology and propose solutions to these problems.