

Generating 3D Models of Shukhov Towers by Laser-Scanning and UAV Photogrammetry

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Laser-scanning and photogrammetry are relevant techniques for raw data acquisition for 3D modelling in Cultural Heritage and other applications. Mostly these techniques are considered as competitive. But in reality they have complementary properties, which should be used synergetically for high quality model generation. Our paper will report about the recording and 3D modelling of two tall Shukhov towers by terrestrial laser-scanning and UAV- and terrestrial photogrammetry. Within the framework of a large international research project concerning Shukhov's lightweight structures our task consisted in generating accurate and largely complete models of two Shukhov towers, Schabolovskaya and Polibino, both in Russia. For non-technical reasons both techniques are used here independently of each other.

The aim of the project part discussed here is to create an accurate and complete geometric documentation of these towers, to analyze the interdependence of the key elements and to reveal the actual structural behavior. The precise 3D computer models of towers have to be created as a basis for all spatially-related investigations and will allow to generate relevant data, useful for scientific investigations, restoration, analytic and educational tasks.

The measurements have been taken by terrestrial laser-scanning and by using the UAV Falcon-8, equipped with an array of sensors, like GPS, INS, stabilization platform and the

Panasonic Lumix LX-5 camera. Although not planned in the beginning, due to special circumstances also terrestrial and elevated cherry-picker photogrammetric images had to be taken. In addition, aerial images over the area around Schabolovskaya are available for modeling the immediate environment of the object.

The processing of the UAV imagery is done jointly by the Institute of Conservation and Building Research (IDB), ETH Zuerich and the Laboratory of Computer Machine Vision of GosNIIAS (State Research Institute of Aviation Systems), Moscow.

The terrestrial laser-scanning and the related point cloud processing was performed by the Center for Virtual History of Science and Technology, a division of the S.I. Vavilov Institute for the History of Science and Technology of the Russian Academy of Sciences, with support of the Trimetari Consulting.

A 3D model of the tower was created based on the results of laser scanning and available documentation (primarily, the measurements of the year 1947). We created both a solid 3D model (only rings and legs), and a meshed 3D model (rings, legs and junctions).

While the laser-scanning data processing and modelling is largely completed, the UAV-based and terrestrial data processing work is still ongoing. We report here about the state of our work and the experiences gained.