Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-1/W4, 227-232, 2015
https://doi.org/10.5194/isprsarchives-XL-1-W4-227-2015

Volume XL-1/W4

26 Aug 2015

A METHOD FOR SIMULTANEOUS AERIAL AND TERRESTRIAL GEODATA ACQUISITION FOR CORRIDOR MAPPING

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Keywords: Unmanned Aerial Vehicle (UAV), geomatics, corridor mapping, Terrestrial Mobile Mapping (TMM), integrated sensor orientation (ISO), Galileo E5 AltBOC, EGNOS

Abstract. In this paper, we present mapKITE, a new mobile, simultaneous terrestrial and aerial, geodata collection and post-processing method. On one side, the method combines a terrestrial mobile mapping system (TMMS) with an unmanned aerial mapping one, both equipped with remote sensing payloads (at least, a nadir-looking visible-band camera in the UA) by means of which aerial and terrestrial geodata are acquired simultaneously. This tandem geodata acquisition system is based on a terrestrial vehicle (TV) and on an unmanned aircraft (UA) linked by a 'virtual tether', that is, a mechanism based on the real-time supply of UA waypoints by the TV. By means of the TV-to-UA tether, the UA follows the TV keeping a specific relative TV-to-UA spatial configuration enabling the simultaneous operation of both systems to obtain highly redundant and complementary geodata.

On the other side, mapKITE presents a novel concept for geodata post-processing favoured by the rich geometrical aspects derived from the mapKITE tandem simultaneous operation. The approach followed for sensor orientation and calibration of the aerial images captured by the UA inherits the principles of Integrated Sensor Orientation (ISO) and adds the pointing-and-scaling photogrammetric measurement of a distinctive element observed in every UA image, which is a coded target mounted on the roof of the TV. By means of the TV navigation system, the orientation of the TV coded target is performed and used in the post-processing UA image orientation approach as a Kinematic Ground Control Point (KGCP). The geometric strength of a mapKITE ISO network is therefore high as it counts with the traditional tie point image measurements, static ground control points, kinematic aerial control and the new point-and-scale measurements of the KGCPs. With such a geometry, reliable system and sensor orientation and calibration and eventual further reduction of the number of traditional ground control points is feasible.

The different technical concepts, challenges and breakthroughs behind mapKITE are presented in this paper, such as the TV-to-UA virtual tether and the use of KGCP measurements for UA sensor orientation. In addition, the use in mapKITE of new European GNSS signals such as the Galileo E5 AltBOC is discussed. Because of the critical role of GNSS technologies and the potential impact on the corridor mapping market, the European Commission and the European GNSS Agency, in the frame of the European Union Framework Programme for Research and Innovation “Horizon 2020,” have recently awarded the “mapKITE” project to an international consortium of organizations coordinated by GeoNumerics S.L.

Conference paper (PDF, 920 KB)

Citation: Molina, P., Blázquez, M., Sastre, J., and Colomina, I.: A METHOD FOR SIMULTANEOUS AERIAL AND TERRESTRIAL GEODATA ACQUISITION FOR CORRIDOR MAPPING, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XL-1/W4, 227-232, https://doi.org/10.5194/isprsarchives-XL-1-W4-227-2015, 2015.

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