

# Introducing a New Class of Survey–Grade Laser Scanning with Unmanned Aerial Systems (UAS)

Philipp Amon, Peter Rieger, Ursula Riegl and Martin Pfennigbauer (Austria)

**Key words:** Bridge surveying; Deformation measurement; Engineering survey; Laser scanning; Mine surveying; UAS, Unmanned Aerial System, UAV, surveying, laser scanner, forestry, corridor mapping, pipe line monitoring, echo digitization

## SUMMARY

Unmanned Aerial Systems (UAS) – until some years ago most restricted to the use for military applications - are about to capture the commercial and civil market. Advanced systems providing first-class technique for this new dynamic topic are becoming available now. To meet the requirements of LiDAR instruments used with UAS applications, RIEGL comes up with a new class of survey-grade laser scanner. We provide insights on the employed technologies as well as on integration and operation of the instrument. The results of first field test are analyzed with respect to measurement precision, resolution, and other application-related aspects like provided point attributes, thus opening up new possibilities of using laser scanners with UAS in commercial and civil surveying and monitoring applications. The new RIEGL VU-XX is a very lightweight and compact laser scanner, meeting the challenges of emerging survey solutions by UAS and ultra-light aircraft, both in measurement performance and in system integration. With regard to the specific restrictions and flight characteristics of UAS, the scanner is designed to be mounted in any orientation. It is tailored for platforms with limited weight, space, and supply power for payloads. The entire data set of an acquisition campaign is stored onto an internal 360 GByte SSD and/or provided as real-time line scan data via the integrated LAN-TCP/IP interface for post-processing. The VU-XX offers high-accuracy laser ranging based on RIEGL's unique echo digitization and online waveform processing, which enables achieving superior measurement results even under adverse atmospheric conditions, and the evaluation of multiple target echoes. The scanning mechanism is based on an extremely fast rotating mirror, which provides fully linear, unidirectional and parallel scan lines, resulting in excellent regular point pattern distribution. Employing such cutting edge LiDAR technology enables operation at up to 500 kHz measurement rate, with a maximum scan speed of 200 scans/sec, and at an operational flight altitude of 350 m. With its high-resolution multi target capability the instrument is excellently suited for agricultural and forestry applications, power line, railway track or pipeline inspection, as well as surveying of urban environments, surveying and monitoring in open-pit mining, or terrain and canyon mapping, to name just a few possible applications.