

MAPPS Geospatial Products and Services Excellence Awards 2018 Entrant

Category: G. Technology Innovation

The Evolution of Mobile: The *RIEGL* VMX-2HA

1. Complexity

LiDAR is a standard tool in the industry for businesses who wish to give themselves a competitive edge in their respective markets. As these companies have continued to grow and flourish, their needs have been rapidly changing and evolving and the demands of what is needed out of LiDAR sensors and systems have been increasing accordingly.

LiDAR systems and sensors have to be designed and adapted to not only meet these needs but to exceed them and grow with businesses' changing requirements. This concept and implementation of it rings particularly true with the *RIEGL* mobile laser scanning systems.

RIEGL mobile scanning systems have been a long-standing symbol of innovation in the industry. The scanners and systems, from their introduction to the market, have been designed to collect robust LiDAR point clouds from moving platforms with survey-grade accuracy and with each system's release into the market, has been a marked improvement upon themselves to further aid the success of the businesses utilizing the systems.

2. Original or Innovative Application/Development of Technologies or Techniques

The latest solution developed by *RIEGL* that furthers the evolution of mobile mapping for the industry is the VMX-2HA high speed, high performance dual scanner mobile mapping system, introduced at INTERGEO 2017. With its upgraded technological factors and upgraded camera capabilities, this system is now the most advanced development of the already proven, compact *RIEGL* VMX mobile mapping platform.

The compact yet powerful technology of the system comprises of two *RIEGL* VUX-1HA high accuracy LiDAR sensors and a high-performance INS/GNSS unit, housed in an aerodynamically-shaped protective cover, which provides an accurate and long-term stable system calibration. The alignment and placement of the two VUX-1HA scanners keeps within the proven VMX tradition with a simultaneous forward/backward look to reduce shadows within the scan.

The VMX-2HA impresses with an extremely enhanced camera performance and a number of new features. A camera interface for up to nine optional camera enables complementation of the LiDAR data with precisely geo-referenced images. These multiple high-resolution *RIEGL* cameras allow for unique capture angles and a high degree of details in the images.

The VMX-2HA mobile mapping system, providing interface and SYNC for up to nine external devices, allows for a flexible combination of different camera configurations such as high-sensitivity 5MP, 9MP, and 12MP *RIEGL* cameras, FLIR Ladybug 5+, and DSLR cameras such as Nikon D810 or Sony Alpha. The modular setup of the system allows the camera configuration to be changed or upgraded at any time.

Multiple 5MP, 9MP, or 12MP *RIEGL* cameras can be used to enable full capture of the surroundings. These special, highly sensitive cameras have cutting-edge CMOS technology for high resolution images and high frame rates. The camera's CMOS global shutter sensor is responsible for a higher dynamic range, less smearing effects caused by sunlight, greater details in shadows and highlights, and low temporal dark noise for more signal gain up to 40dB.

The new Ladybug 5+ panorama camera integration improves time stamping and enables fully integrate camera operation within the *RIEGL* system operating software.

The provided camera ports enable unique flexibility to select the optimal position and orientation of the cameras to meet specific project requirements. Each single camera can be mounted and dismounted smoothly with accurate reproducibility of its position and orientation.

The six side-facing cameras are optimized for capturing traffic signs, overhead structures, building structures, and facades while the rear port is optimized to carry a close to NADIR downward looking camera that offers detailed capture of the road surface, reliable data for pavement analysis and crack indexing, and very little distortion of the projected image on the road surface.

Another new addition to the VMX-2HA to further improve workflows for the end user was the complete re-design of the interface between the VMX-MH (Measuring Head) with scanners and cameras and the VMX-CU (Control Unit).

The VMX-CU (equipped with a high performance 3rd generation Intel Core i7 processor) precisely controls management of power, data acquisition, and operation of the laser scanners, INS/GNSS sensors, and the optional cameras. A 10 GigE network and a set of SSD storage media with a total of 6TB disk space enables big data handling for uninterrupted data recording of comprehensive missions and allows for the smooth acquisition of the data and camera imagery.

A handy touchscreen and the *RIEGL* data acquisition software facilitates the operator's task in the field by providing real-time visualization of acquired scan data and imagery while the seamless *RIEGL* workflow for mobile data acquisition, processing, and adjustment is provided by *RIEGL*'s proven software suite.

The *RIEGL* software packages also offer comprehensive features in data processing. This covers enhanced alignment algorithms to merge multiple passes from mobile scan data. Furthermore, it enables scan data to be fitted to specific control objects, which results in a consistent point cloud of enhanced precision and increased geo-referenced accuracy. Finally, the precise geo-referenced scan data and high resolution images can be exported to well-known file formats or interfaced directly with third-party software.

The modular design of the system and enhanced software capabilities provides unique flexibility to meet a diversity of project requirements. With its capability of capturing two million measurements and five hundred scan lines per second, this turnkey solution is ideally suited for survey-grade mobile mapping applications including but not limited to transportation infrastructure mapping, road surface measurements, city modeling, rapid capture of construction sites and bulk material, surveying in open-pit mining, GIS mapping and asset management, as-built surveying, and railway mapping.

3. Future Value to the Geospatial Profession and the Public

With the release of the VMX-2HA into the market, *RIEGL*'s proven mobile LiDAR technology has evolved further to meet both customer and market needs. The system's hardware design and software capabilities allow for future upgrades to occur as they are required and as the needs for mobile LiDAR change and develops. The new focus on cameras with the implementation of a high-speed data link enables more imagery data to be captured than ever before.

With the needs of businesses and the market changing constantly, LiDAR sensors and systems must be adaptable and flexible to change with the times and to give businesses a competitive edge. The VMX-2HA provides this with both its hardware and software. The system's ability to upgrade cameras as optimized versions release and the ability to update software as improvements continue to come out give the end user the ultimate system that grows and changes with their requirements. The VMX-2HA isn't merely just a new development, it is an evolution.