About *RIEGL*





Innovation in 3D

Agenda

About *RIEGL*

RIEGL has been producing LiDAR systems commercially for more than 40 years and focuses on pulsed time-of-flight laser radar technology in multiple wavelengths. *RIEGL's* core "smart waveform" technologies provide pure digital LiDAR signal processing, unique methodologies for resolving range ambiguities, multiple targets per laser shots, optimum distribution of measurements, calibrated amplitudes and reflectance estimates, as well as the seamless integration and calibration of systems.

RIEGL's various 3D scanners offer a wide array of performance characteristics and serve as a platform for continuing "Innovation in 3D" for the laser scanning industry.

From consultation and quotation to integration of the system, as well as training and support, *RIEGL* maintains an out-standing history of reliability and support to their customers.

The *RIEGL* staff comprises 220 highly skilled and motivated engineers, technicians, and other qualified employees.

About *RIEGL*

Worldwide sales, trainings and services

Headquarters and offices in Austria:

Horn
Vienna
Salzburg
Styria

Main offices:

Winter Garden, FL, USA
Tokyo, Japan
Beijing, China
Southport, Australia
Toronto, Canada
York, United Kingdom

Worldwide network of **distribution partners**

About *RIEGL*

Marketing, Sales, Training & Administration

Vienna Office, Millennium Tower

The *RIEGL* headquarters provide more than 40,000 square feet work space for research, development, production as well as for marketing, sales, training and administration. Another 350,000 square feet of open-air ground is used for product testing.

In 2021, an additional manufacturing building in Horn, which will almost double the currently available operating space, will be ready for move in.

additional new building

About *RIEGL*

Airfield for UAV tests and demo flights, Frauenhofen, Horn

Airfield for UAV tests and demo flights, Styria

To meet or to exceed the requirements

Electromagnetic Compatibility Check

Every *RIEGL* Laser Scanner has to meet or exceed the requirements of the European Standard EN 61326-1:2013 concerning electrical equipment for measurement, control and laboratory use and is therefore especially tested.

Measuring Section

RIEGL scanners' measuring capability is verified here.

Calibration Field

Before delivery every *RIEGL* terrestrial laser scanner has to stand the proof at the calibration field to review geometric adjustment, compass alignment, internal calibration, etc.

Airfield for UAV Tests

For verification of *RIEGL's* UAV LiDAR sensors' or RiCOPTERs' performance – but also for demo flights – special airfields in Horn and Styria are available.

Electromagnetic compatibility check

Measuring section

Calibration field

RIEGL®

Innovation in 3D

Terrestrial Scanning

Terrestrial Laser Scanning

RIEGL's Terrestrial (Static) Laser Scanners are exceptionally compact and fully portable instruments providing detailed and highly accurate 3D data rapidly and efficiently.

RIEGL's unique Waveform-LiDAR technology – based on echo digitization, online waveform processing, and multiple-time-around processing – is the key for high speed data acquisition. A new processing architecture of the VZ-i Series enables execution of different background tasks (such as point cloud registration, geo-referencing, etc.) on-board in parallel to the acquisition of scan data.

Applications of *RIEGL* terrestrial laser scanners are wide ranging, including topography, as-built surveying, mining, architecture, archeology, cultural heritage documentation, monitoring, civil engineering and city modeling.

RIEGL VZ-i Series

Ultra high-performance 3D terrestrial laser scanning systems

- automatic registration during data acquisition
- simultaneous image and scan data acquisition
- cloud connectivity via Wi-Fi and LTE 4G/3G
- remote control via app
- customizable workflows
- rugged design, fast set-up, user-friendly touch screen
- optional camera, various built-in sensors
- advanced flexibility through support for external peripherals and accessories
- versatility by customized apps delivering real-time on-board final results
- fully compatible with the *RIEGL* VMZ hybrid mobile mapping system
- eye safe operation at laser class 1

RIEGL VZ-400i / VZ-2000i

- up to 1.2 million meas./sec
- range up to 800 / 2,500 m
- accuracy / precision: 5 / 3 mm

RIEGL VZ-Series

3D terrestrial laser scanners for very long ranges

RIEGL VZ-4000

- range up to 4,000 m
- accuracy 15 mm
- Laser PRR up to 300 kHz, *eyesafe Laser Class 1*
- built-in calibrated digital camera

RIEGL VZ-6000

- range up to 6,000 m
- accuracy 15 mm
- Laser PRR up to 300 kHz, *Laser Class 3B*
- exceptionally suited for measuring snowy and icy terrain
- built-in calibrated digital camera

Airborne Scanning

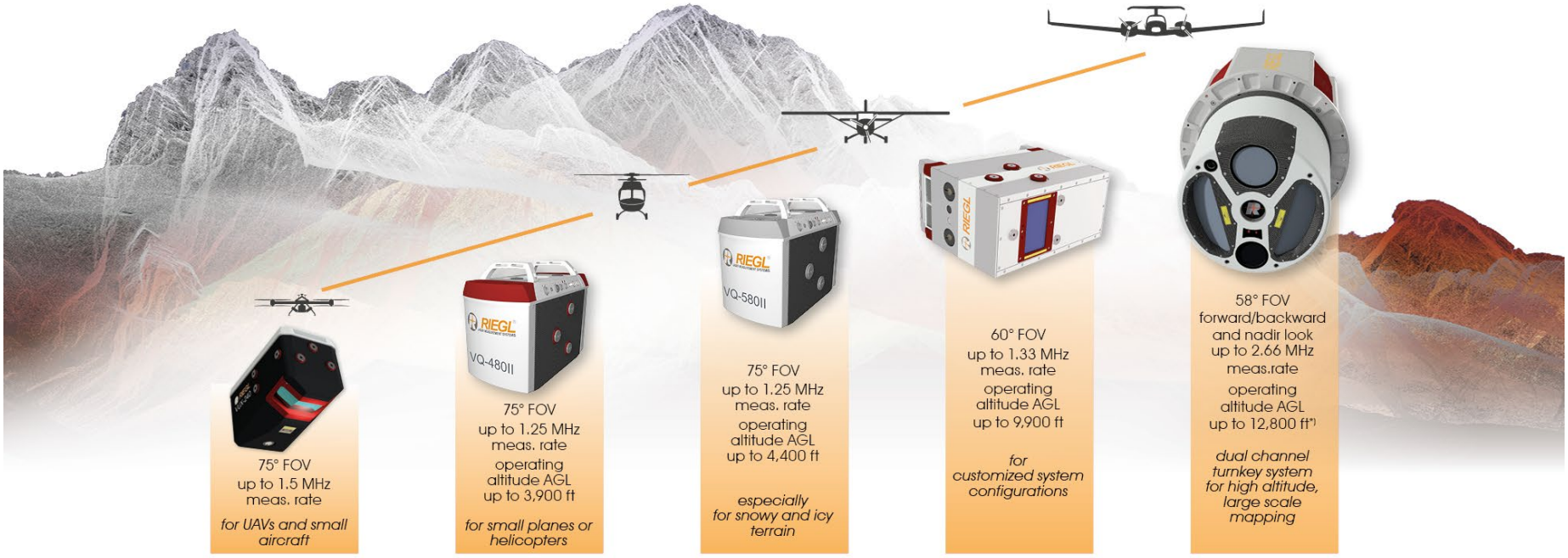
Airborne Laser Scanning

ALS

Airborne (Kinematic) Laser Scanning is a rapid, highly accurate and efficient method of capturing 3D data of large areas, such as agricultural or forestry sites, urban areas, industrial plants, power line or railway corridors, etc.

RIEGL offers various ingenious solutions optimally tailored to the missions‘ requirements – from single laser scanner engines to fully integrated laser scanning systems and well-developed turnkey solutions.

RIEGL®



75° FOV
up to 1.5 MHz
meas. rate
for UAVs and small aircraft

75° FOV
up to 1.25 MHz
meas. rate
operating
altitude AGL
up to 3,900 ft
for small planes or helicopters

75° FOV
up to 1.25 MHz
meas. rate
operating
altitude AGL
up to 4,400 ft
especially for snowy and icy terrain

60° FOV
up to 1.33 MHz
meas. rate
operating
altitude AGL
up to 9,900 ft
for customized system configurations

58° FOV
forward/backward
and nadir look
up to 2.66 MHz
meas.rate
operating
altitude AGL
up to 12,800 ft[*)]
dual channel turnkey system for high altitude, large scale mapping

VUX-240	VQ-480 II	VQ-580 II	VQ-780 II	VQ-1560 II / II-S

for surveying at low flight altitudes
e.g. powerline, rail track, pipeline inspection, and archeology

for surveying at mid flight altitudes
e.g. corridor mapping, city modeling, agriculture, and forestry

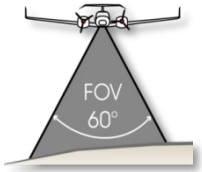
for surveying at high flight altitudes
e.g. wide area mapping of complex environments

Airborne Laser Scanners

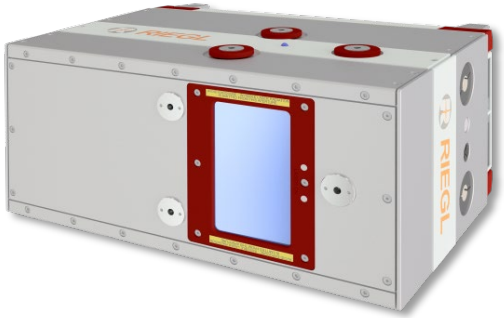
RIEGL VQ-780 II

Waveform Processing Scanner
for Ultra Wide Area Mapping and High Productivity

- online waveform processing as well as smart and full waveform recording
- excellent multiple target detection capability
- excellent suppression of atmospheric clutter
- Multiple-Time-Around (MTA) processing of up to 35 pulses simultaneously in the air
- high laser pulse repetition rate up to 2 MHz
- up to 1.33 million measurements/sec on the ground

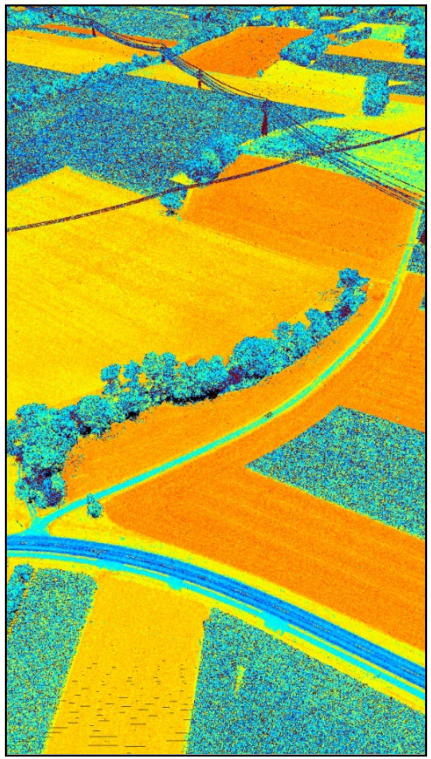


broad effective swath width



RIEGL VUX-1LR

- for airborne surveying from helicopters
- max. operating flight altitude 1,740 ft AGL
- up to 750,000 meas./sec on the ground



RIEGL VQ-480 II scan data

Airborne Laser Scanning Systems

RIEGL VQ-480 II / VQ-580 II

Airborne Laser Scanning System at 1550 nm / 1064 nm wavelength

- **compact & lightweight design:**
  ready for integration in helicopters, small aircrafts,
  or UAVs with higher payload capacity
- high accuracy ranging based on *RIEGL* Waveform-LiDAR technology
- wide field of view of 75°
- pulse repetition rate of up to 2 MHz,
  measurement rate up to 1,250,000 meas./sec
- perfectly linear and parallel scan lines
- interfaces for up to 5 optional cameras
- mechanical and electrical interface for IMU/GNSS integration
- removeable data storage card CFast® and integrated
  Solid State Disk (SSD)
- compatible with stabilized platforms and even small hatches

RIEGL®

Dual Channel Waveform Processing Airborne LiDAR Systems

fully integrated with IMU/GNSS and cameras

- online waveform processing and smart and full waveform recording
- up to 2.66 million measurements/sec on the ground

RIEGL VQ-1560 II

two infrared laser channels for a high maximum range and a wide selection of point densities with an optimum distribution of the measurements on the ground

- for large scale, high altitude, complex environment mapping
- measurement range up to 4,500 m (target reflectivity ≥ 20%)

NEW RIEGL VQ-1560 II-S

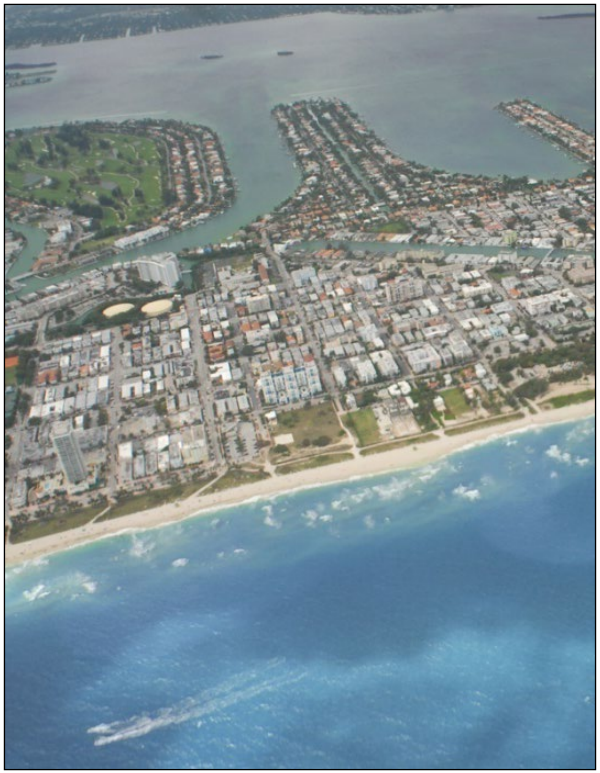
with increased laser power for ultra-wide area mapping

- measurement range up to 4,800 m (target reflectivity ≥ 20%)

RIEGL VQ-1560-DW

enhanced target characterization by simultaneous measurements at **green and infrared laser wavelengths**

RIEGL®



Topo-Bathymetric Airborne Laser Scanning Systems

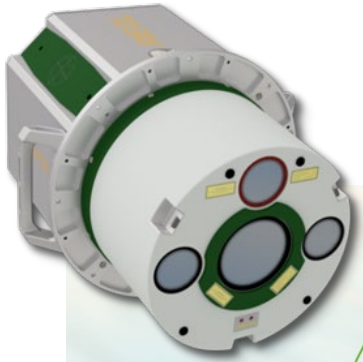
fully integrated with IMU/GNSS and cameras

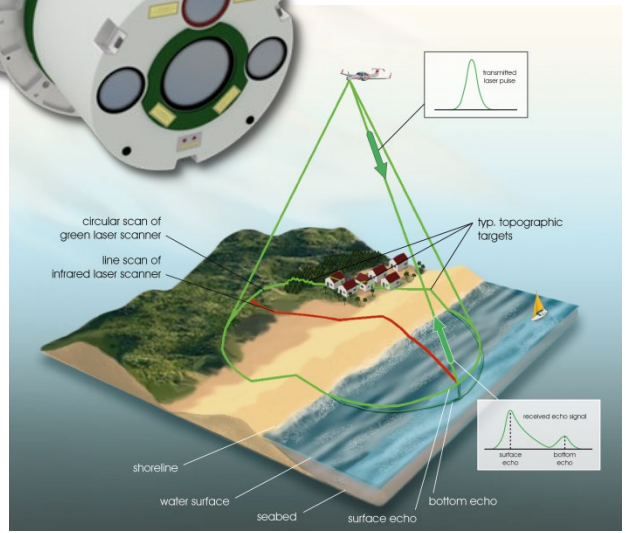
RIEGL VQ-880-G II

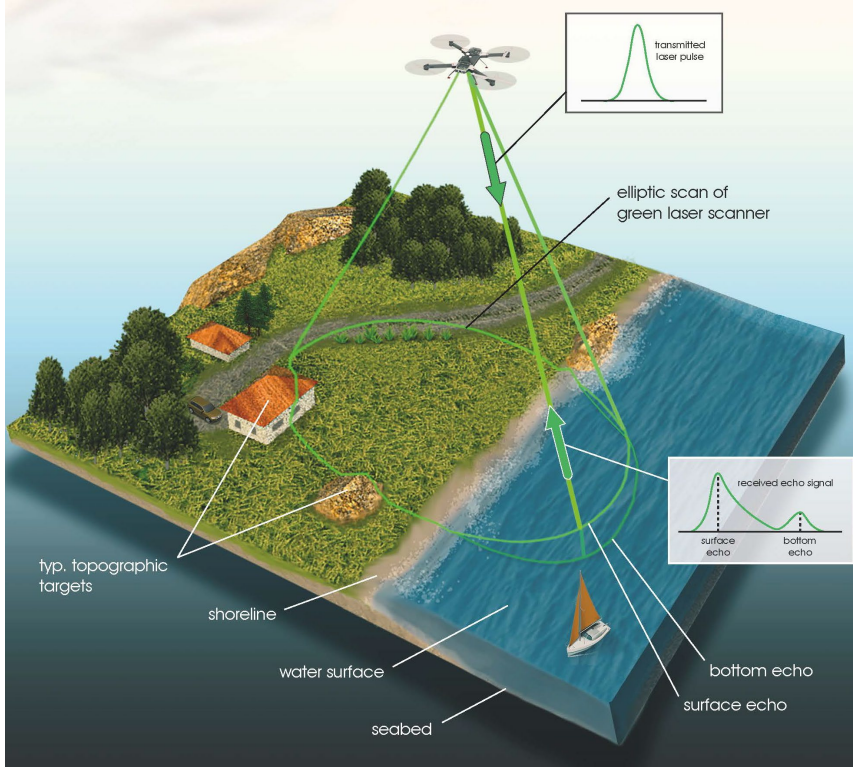
- for coastline and shallow water mapping
- visible green laser beam, water penetration 1.5 Secchi depths
- infrared channel (optional) for detection of the water surface

RIEGL VQ-880-GH

- optimized form factor for helicopter integration







Topo-Bathymetric Airborne Laser Scanner

with Online Waveform Processing and Full Waveform Recording

RIEGL VQ-840-G

- compact and lightweight design
- visible green laser beam
- water penetration ≥ 2 Secchi depths
- high spatial resolution due to measurement rate up to 200 kHz and high scanning speed of up to 100 scans/sec
- integrated inertial navigation system (optional)
- high-resolution digital camera and IR laser rangefinder on request
- for installation on various platforms including UAVs

RIEGL®

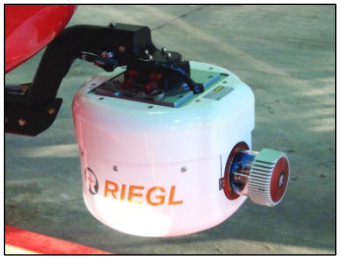
RIEGL Helicopter Pod for Airborne Laser Scanning

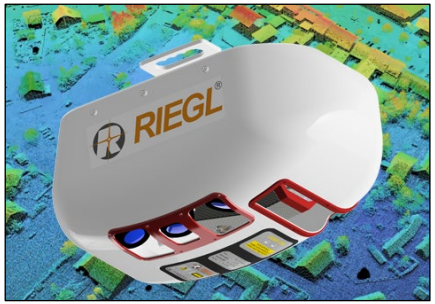
- robust and reliable airborne scanner carrying platform
- full mechanical and electrical integration of sensor system components into aircraft fuselage
- quick installation & removal using the existing mounts (e.g. AirFILM Camera System); mounting and operation at end user's responsibility
- area exposed to wind approx. 0,114 m^2

RIEGL VP-1 with *RIEGL* VUX-1

RIEGL VUX-1LR or VUX-1UAV LiDAR Sensor, IMU/GNSS unit with antenna, control unit, and digital camera(s) fully integrated

- total weight approx. 19 kg





NEW RIEGL VPX-1 with VUX-240

RIEGL VUX-240 LiDAR Sensor, control unit, up to 3 Sony Alpha digital cameras and a high-end IMU/GNSS system with antenna fully integrated

- total weight approx. 20 kg

Mobile Scanning

Mobile Laser Scanning

Mobile (Kinematic) Laser Scanning enables rapid and efficient data acquisition from a variety of moving platforms, such as cars, railway vehicles, ships, boats, etc.

Mobile Laser Scanner

RIEGL VUX-1HA

- compact, rugged, and lightweight design
- easily mountable to whatsoever type of moving platform
- high accuracy of 5 mm
- up to 1,000,000 meas./sec
- extremely high measurement speed (1 MHz PRR, 250 scans/sec)
- 360° Field of View

Mobile Mapping System

RIEGL VMX-2HA

High Speed, High Performance Dual Scanner Mobile Mapping System

- **2 *RIEGL* VUX-1HA laser scanners** and high accuracy IMU/GNSS unit fully integrated
- **up to 2 MHz effective measurement rate, up to 500 scan lines/sec**
- 5 mm accuracy, 360° vertical field of view
- user-friendly mounting
- aerodynamically-shaped protective cover
- camera interface for up to 9 optional cameras
- **flexible combination of different camera configurations**
  - high-sensitivity 5MP and 12MP *RIEGL* cameras
  - spherical camera FLIR Ladybug® 5+
  - DSLR camera such as Nikon D850 or Sony Alpha

RIEGL VMX-2HA equipped with FLIR Ladybug® 5+ camera

RIEGL VMX-2HA equipped with *RIEGL* cameras

RIEGL VMX-2HA-BC (Basic Configuration)

- weight and size reduced version focusing on high-end scanning performance
- with an optional spherical imaging system such as FLIR Ladybug® 5+ camera

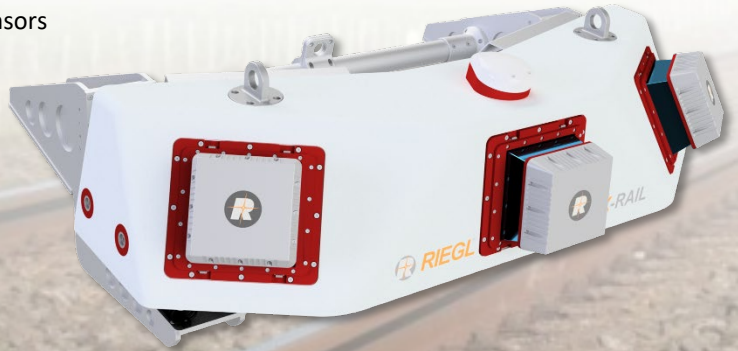
Mobile Mapping System

RIEGL VMX-RAIL

Triple Scanner Mobile Mapping System
Specifically Designed for Track Mapping and Clearance Surveying

- rugged measuring-head for reliable long-term operation in harsh environments equipped with 3 VUX-1HA laser scanners
- 3MHz pulse repetition rate and 750 lines/sec resulting in up to 7000 pts/m^2 in 3m range at 80 km/h platform speed
- enables the capture of the complete rail corridor, including catenary systems, rail heads, and the complete periphery, even signs orthogonal to running direction
- optionally integrated camera system and open interfaces to various sensors
- data export to Third-Party Rail-Processing Software Packages


customized integration example



Mobile Mapping Systems

RIEGL VMZ

Hybrid Mobile Mapping System

- IMU/GNSS unit, fully integrated to support ***RIEGL* VZ-400i** or **VZ-2000i** scanners for mobile (kinematic) data acquisition
- fast transition from tripod to mobile mount – high stability of boresight system calibration
- optional image data acquisition with fully integrated cameras

RIEGL VMZ in action

static scanning

easy mounting

RIEGL VMQ-1HA

High Speed, Single Scanner Mobile Mapping System

- 1 *RIEGL* VUX-1HA laser scanner and IMU/GNSS unit fully integrated
- up to 1 MHz effective measurement rate
- up to 250 scan lines/sec
- 360° vertical field of view
- camera interface for up to 4 optional cameras
- multiple swivel positions of the measuring head

Unmanned Scanning

RIEGL®

Unmanned Laser Scanning

ULS

Laser scanning utilizing high-end unmanned airborne platforms provides the possibility to acquire data in dangerous and / or hard-to-reach areas, while offering an excellent cost-to-benefit-ratio for numerous applications, e.g. corridor mapping, forestry and mining.

LiDAR Sensors for Unmanned Aircraft

RIEGL VUX-1UAV

- 3.5 kg / 7.7 lbs
- up to 500 kHz Laser PRR
- accuracy 10 mm
- operating flight altitude more than 1,000 ft

RIEGL miniVUX-1DL

Downward-Looking

- optimized design for corridor mapping applications
- 100 kHz Laser PRR
- range up to 1050 m @ ρ ≥ 80%

RIEGL miniVUX-1 Series

- 1.55 kg / 3.4 lbs
- accuracy 15 mm

RIEGL miniVUX-1UAV

- 100 kHz Laser PRR
- range up to 330m @ ρ ≥ 80%

RIEGL miniVUX-2UAV

200 kHz / 100 kHz Laser PRR selectable:

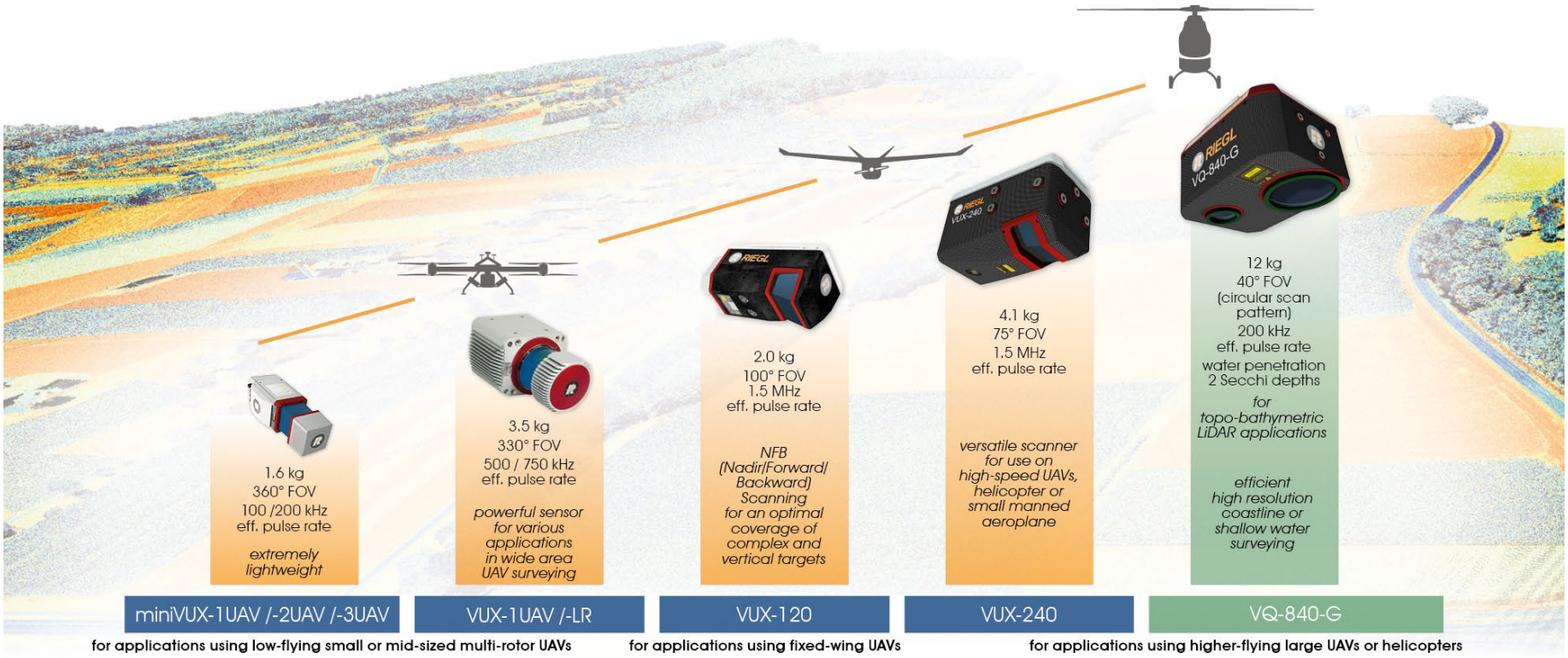
- range @ 200 kHz: up to 280 m @ ρ ≥ 80%
- range @ 100 kHz: as given for miniVUX-1UAV

NEW RIEGL miniVUX-3UAV

300 kHz / 200 kHz / 100 kHz Laser PRR selectable:

- range up to 330 m @ ρ ≥ 80%
- FoV: 120° @ 300 kHz, 180° @ 200 kHz, 360° @ 100 kHz

RIEGL®



for applications using low-flying small or mid-sized multi-rotor UAVs
e.g. mining, topography, forestry, landslide and avalanche monitoring

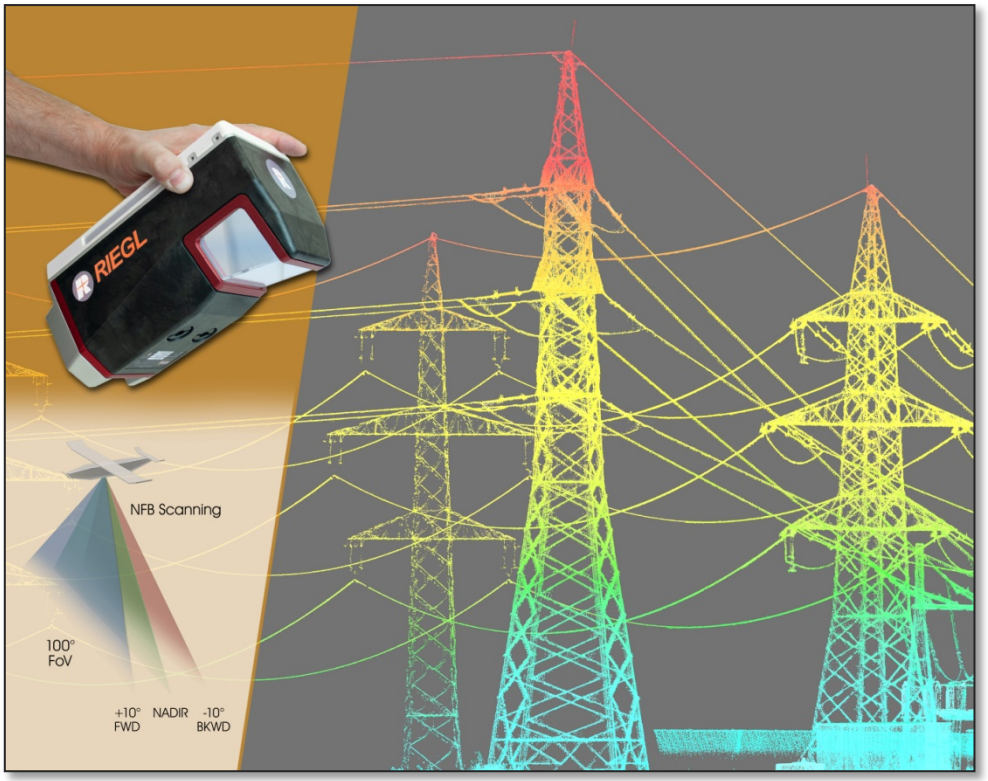
for applications using fixed-wing UAVs
e.g. corridor mapping, city modeling

for applications using higher-flying large UAVs or helicopters
e.g. mapping with the need of detailed high-resolution data

NEW RIEGL VUX-120

The Ultimate UAV LiDAR Sensor for Corridor Mapping

- **NFB (Nadir/Forward/Backward) Scanning**
  for unrivaled completeness of scan data even on vertical structures and narrow canyons
- measurement rate up to 1,500,000 meas./sec
- scan speed up to 400 lines/second
- operating flight altitude up to 720m / 2,350 ft
- field of view up to 100°
- cutting edge *RIEGL* technology providing:
  - echo signal digitization
  - multiple target capability
  - online waveform processing
  - multiple-time-around processing
- mechanical and electrical interface for optional INS/GNSS integration
- interfaces for up to 2 external cameras
- scan data storage on internal 1 TByte SSD Memory
- removeable CFAST memory card up to 256 GB



RIEGL VUX-240

Compact & Lightweight UAV Laser Scanner

- **easily mountable to unmanned platforms (UAVs) or to helicopters, gyrocopters, and other small manned aircrafts**
- laser pulse repetition rate up to 1.8 MHz
- measurement rate up to 1,500,000 meas./sec
- scan speed up to 400 lines/second
- operating flight altitude up to 1,400m / 4,600 ft
- field of view up to 75°
- perfectly linear and parallel scan lines
- cutting edge *RIEGL* technology providing:
  - echo signal digitization
  - multiple target capability
  - online waveform processing
  - multiple-time-around processing
- mechanical and electrical interface for optional INS/GNSS integration
- interfaces for up to 4 optional cameras
- scan data storage on internal 1 TByte SSD Memory

Laser Scanning System for Unmanned Aircraft

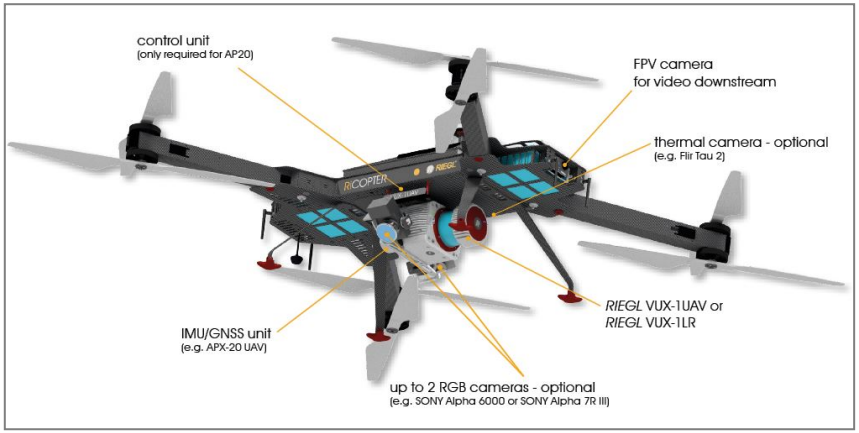
RIEGL VUX-SYS

The *RIEGL* VUX-SYS is a complete laser scanning system of low weight and compact size for flexible use in kinematic applications.

- fully integrated *RIEGL* LiDAR sensor VUX-1UAV/VUX-1LR or VUX-240
- inertial measurement unit and GPS/GLONASS receiver integrated
- various mounting options for highly flexible installation
- optional camera integration
- dependent on scanner and IMU/GNSS unit used, the system can be used flexibly for different applications (e.g., VUX-SYS with VUX-1 for both, RiCOPTER and VMQ)

***RIEGL* VUX-SYS installed in RiCOPTER**

- *RIEGL* VUX-1UAV LiDAR sensor, IMU/GNSS unit, GNSS antenna, control unit, and 2 cameras fully integrated
- 10 mm accuracy
- up to 350,000 meas./sec, 230° field of view



RIEGL VUX-SYS mit VUX-1 LiDAR sensor for RiCOPTER

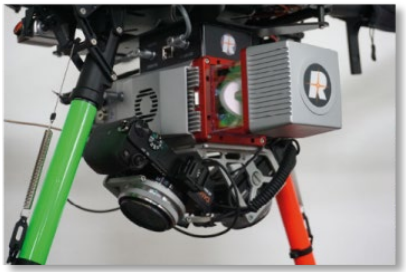
Laser Scanning System for Unmanned Aircraft

RIEGL miniVUX-SYS

The *RIEGL* miniVUX-SYS is a complete miniaturized & lightweight laser scanning system of low weight and compact size for flexible use in UAV-based applications on a variety of UAV/UAS/RPAS.

- *RIEGL* miniVUX Series LiDAR sensor fully integrated
- different IMU/GNSS options available
- various mounting options for highly flexible installation
- prepared for remote control via low-bandwidth data link
- prepared for interfacing with optional RGB camera(s) and thermal imaging sensor(s)
- **Integration Kit 600** available for straight forward system integration with selected multi-rotor UAV types

***RIEGL* miniVUX-SYS with APX-15 UAV**
Delair DT26X fixed-wing integration example with *RIEGL* miniVUX-1DL LiDAR sensor equipped with APX-15 UAV



***RIEGL* miniVUX-SYS with APX-20 UAV**
RIEGL miniVUX-1UAV LiDAR sensor equipped with APX-20 UAV

***RIEGL* Integration Kit 600**
add-on to the miniVUX-SYS coming with shock-absorbing mounting-kit, power supply module and cabling

Remotely Piloted Aircraft Systems

equipped with RiCOPTERControl (RiCC) redundant flight control system developed and produced by *RIEGL*.

RiCOPTER

- high-performance X8 array foldable octocopter
- carbon fiber main frame, foldable propeller carrier arms, and shock-absorbing undercarriage for stable flights, landings and comfortable transportation
- **MTOM (Maximum Take-Off Mass) 25 kg**
- **max. sensor payload up to 6.5 kg**
- flight endurance 30 min
- **versatile carrier platform:**
  - integration of various sensors possible, e.g. *RIEGL* VUX-SYS laser scanning system or bathymetric depth finder BDF-1

RiCOPTER-M

- equipped with special aviation safety features and ADS-B/Mode-S transponder
- **MTOM (Maximum Take-Off Mass) 40 kg**
- **max. sensor payload up to 15 kg**

RiCOPTER-M equipped with ADS-B/Mode-S transponder

RiCOPTER ready to take off

Distributed, supported and serviced by RiCOPTER ... A RIEGL® COMPANY

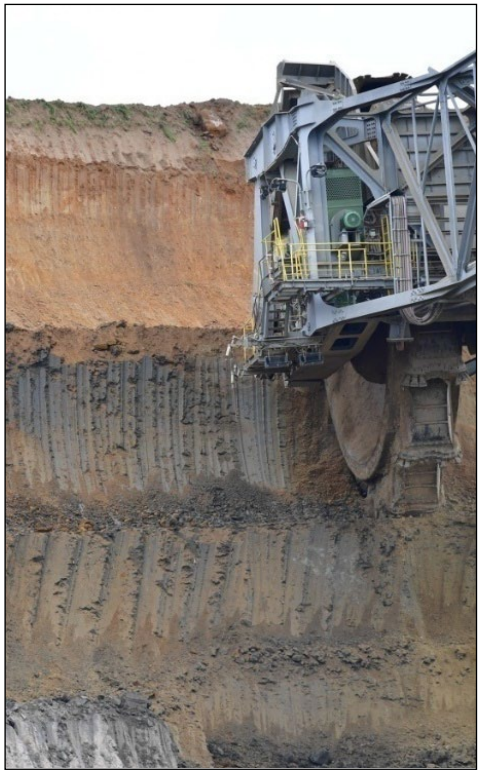
UAV-based LiDAR Surveying System for Hydrographic Applications

BathyCopter

- RiCOPTER equipped with Bathymetric Depth Finder *RIEGL* BDF-1 (comprising of tilt compensator, an IMU/GNSS unit with antenna, a control unit and up to two external digital cameras) providing up to 1.5 Secchi depths measuring range
- ideally suited for generating profiles of inland water bodies
- floating support for safe water landing and take-off from water bodies
- excellent performance even at adverse conditions based on pre-detection averaging
- highly accurate, reliable and informative bathymetric data resulting from *RIEGL*'s proprietary hydrographic waveform processing

Distributed, supported and serviced by RiCOPTER ... A RIEGL® COMPANY

Industrial Scanning



Industrial Laser Scanning

RIEGL offers powerful scanners and scanning solutions for various fields of industrial applications. All these are exceptionally compact, reliable, and provide highest performance and longevity even in harsh and demanding environments.

Laser Scanners

VZ-200

- 3D laser scanner for process automation of stackers and reclaimers, measurement of stock piles and bulk material, surveying and monitoring in topography and mining

Protective Housings

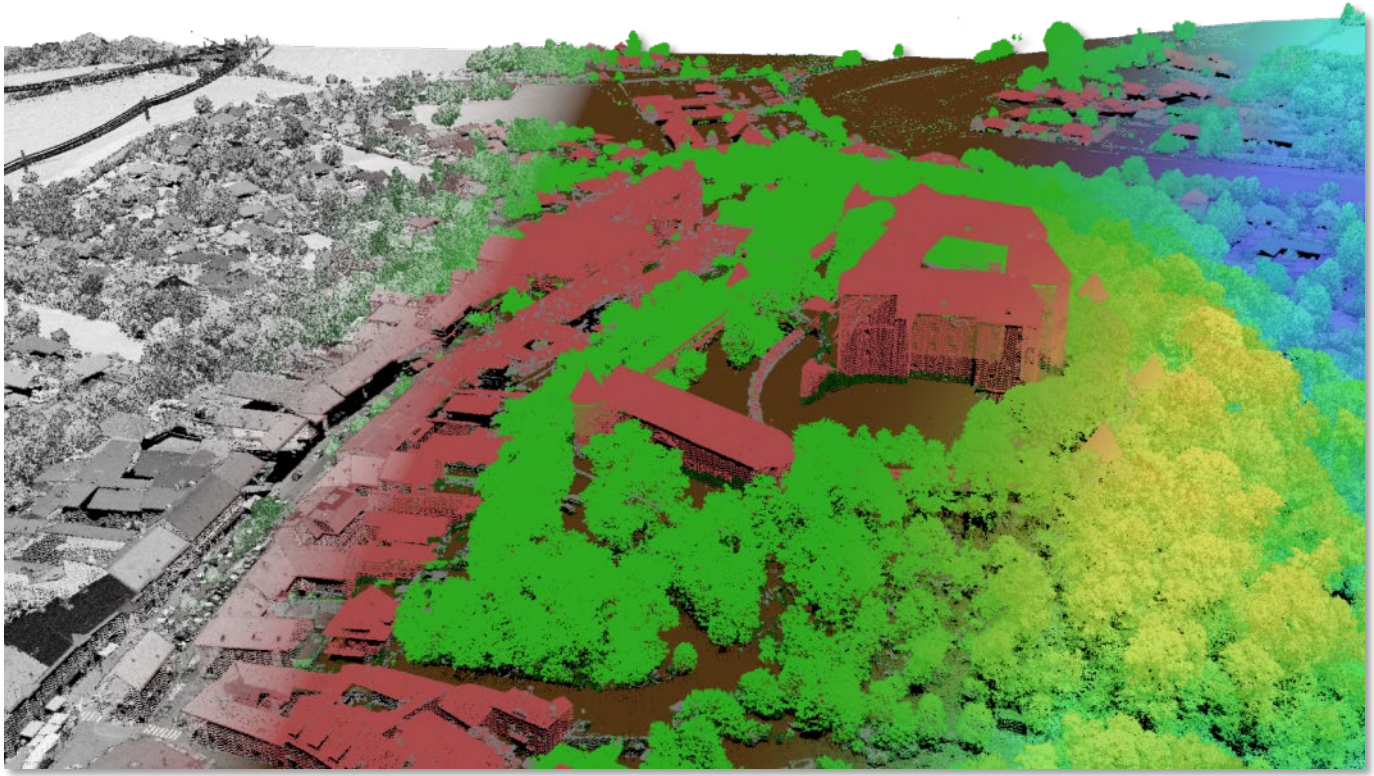
PH-VUX

- protective housing for *RIEGL* VUX-1 Series laser scanners
- hermetically-sealed, with thermo-electric coolers and forced-air cooling

RIEGL PH-400i/2000i and *RIEGL* PH-4000/6000-SRH

- rugged and robust industrial protective housing for *RIEGL* V-Line Terrestrial Laser Scanners
- hermetically-sealed, with thermo-electric coolers and forced-air cooling
- industrial standard connectors and supply cables
- application-specific interface and software solutions

RIEGL Software Packages

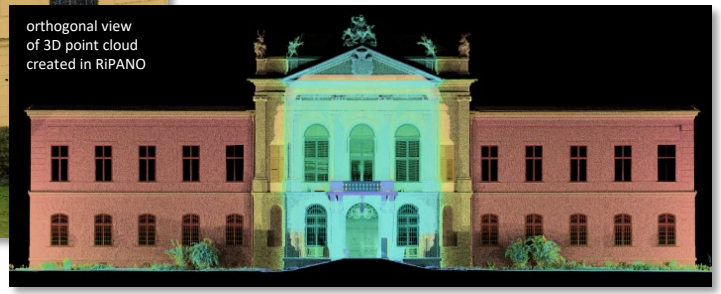


RIEGL Software for TERRESTRIAL Scanning

RiPANO

Explore your project and extract plots in your browser!

- for terrestrial scan data visualization



RIEGL VZ-i Series App

For Remote Scanner Control

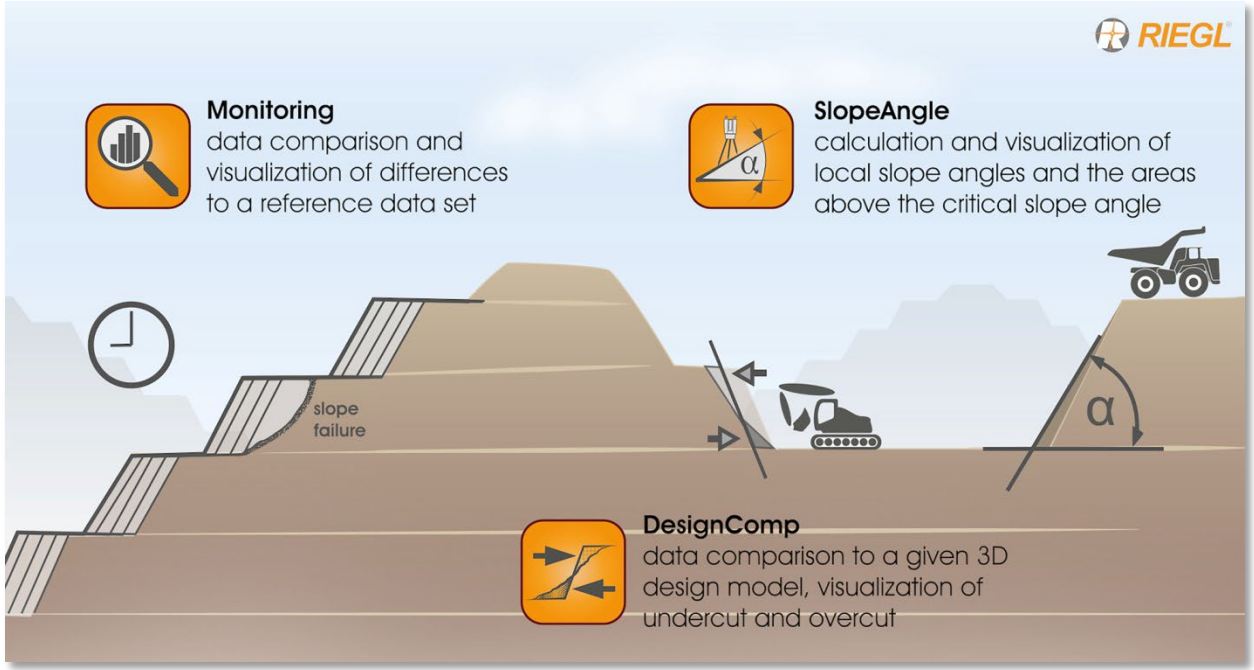
- connection to the scanner via local or remote access
- the graphical user interface (GUI) of the laser scanner is mirrored on the screen of your device
- available on the App Store for iPhone, iPad, iPadtouch, and for Windows and Android devices in the *RIEGL* members area

RIEGL Software for TERRESTRIAL Scanning

NEW RIEGL Mining App

Slope Angle App,
Design Compare App and
Monitoring App are applicable with
***RIEGL* VZ-i Series Laser Scanners**

- real-time data transfer to web browser on every device, which is connected to the mine network
- relevant, reliable and accurate deliverables to make prompt and appropriate decisions



RIEGL Software for TERRESTRIAL and INDUSTRIAL Scanning

RiSCAN PRO

Efficient data acquisition and processing, “one touch” wizard for daily task automation, automatic targetless scandata registration, pointcloud filtering and coloring, RiPANO project publishing

RiMINING

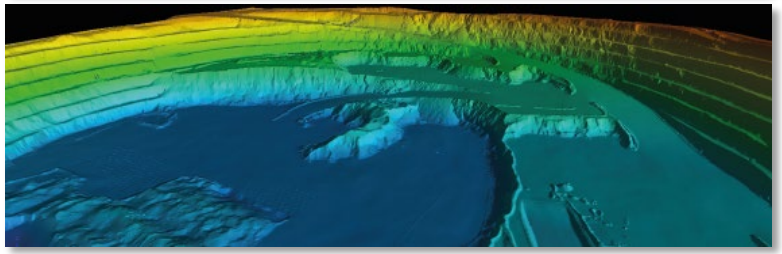
optimizing and simplifying scan data registration and processing workflow for open pit mining, offering, e.g. automatic extraction of breaklines

RiSOLVE

„one touch“ solution for a rapid acquisition and registration of scan data and calibrated camera images by terrestrial *RIEGL* V-Line Laser Scanners, reduces field and post-processing time significantly

GeoSysManager2.0

conversion of coordinates from one geodetic, coordinate reference system to another



RIEGL Software for MOBILE and AIRBORNE Scanning

RiACQUIRE

data acquisition & online visualization

RiPROCESS

workflow control & data management

GeoSysManager2.0

conversion of coordinates from one geodetic, coordinate reference system to another

RiUNITE

full waveform analysis of digitized echo signals, automated resolution of range ambiguities, coordinate transformation

RDB COLORIZER

Add pointcloud color information from imagery

EXPORT MODULE

Export pointcloud data to industry standard exchange formats, e.g LAS

RiHYDRO

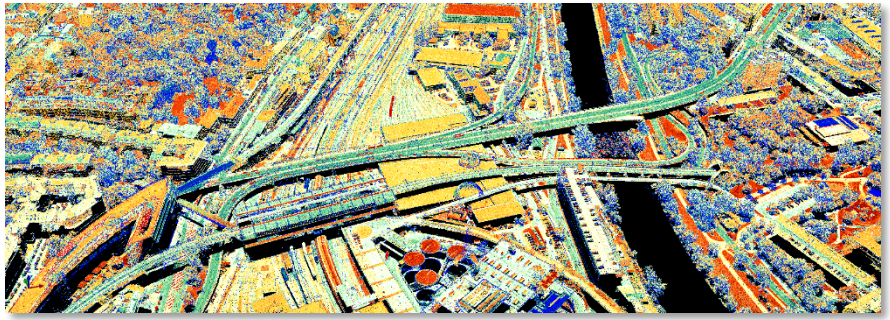
software addon for commercial hydrographic and bathymetric surveying

RiPRECISION

Trajectory adjustments to register overlapping mobile/UAV based scan data completely automatically, expediently, and rigorously

LIS Classification ALS

Pointcloud classification addon for airborne data



Thank you
for your kind attention!





Innovation in 3D