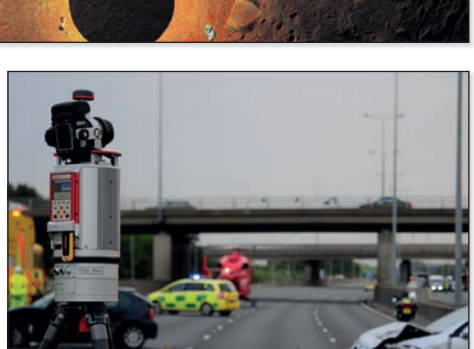
Introduction

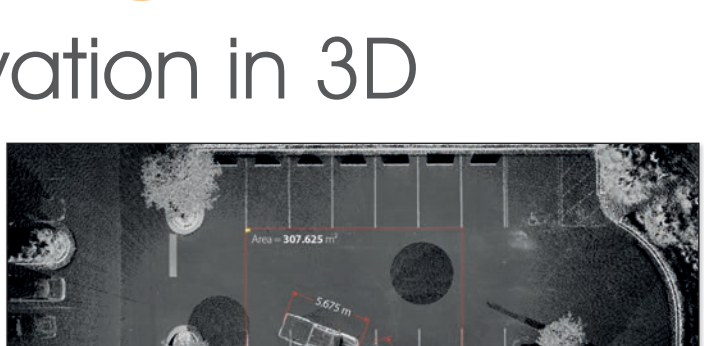
to *RIEGL* Forensic LiDAR Solutions

RIEGL®



RIEGL®

Innovation in 3D



Pictures by courtesy of

Title (copyrights top down from left to right):

first line: © Metropolitan Police U.K., © Kantonspolizei Zürich | second line: © RIEGL, © PP Köln, © RIEGL | third line: © Kantonspolizei Zürich

RIEGL delivers cutting edge technology in terrestrial, airborne, mobile, and unmanned laser scanning solutions. From your initial purchase, to integration of the systems, as well as training and support, *RIEGL* stands out as a leader in the industry. The key factor to *RIEGL's* success is providing complete reliability and support to our customers.

As a result of this success, *RIEGL* is recognized as a performance leader in the forensic, mobile mapping, civil infrastructure, airborne scanning, unmanned, hydrographic, bathymetric, mining and terrestrial based industries. Our instruments are well known for their ruggedness and reliability under demanding environmental conditions. *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 business.

Laser scanning offers many benefits to the forensic world, including:

- **More complete evidence gathering than ever before**
- **Reduced time in the field**
- **Significant road closure time reduction**
- **New, innovative, and engaging ways to present evidence**
- **Data can assist in crime scene and collision analysis**

RIEGL has been creating pulsed laser radar and laser scanning systems since 1968. The introduction of a laser speed gun in 1992 marks *RIEGL's* first successful footprint in the world of police and security forces. The laser speed gun was utilized by traffic law enforcement forces to track the speed of motor vehicles on roadways. The introduction of the *RIEGL* FG21-P in 1998 added a miniaturized, digital laser traffic speed meter with a 1,000 meter range to the *RIEGL* forensic portfolio. *RIEGL* discontinued production of speed meters in 2011 but will continue servicing instruments in use until 2021.

In 2008, *RIEGL* introduced the revolutionary VZ-400 terrestrial laser scanner, the world's first online waveform processing terrestrial laser scanner. This scanner provides high speed terrestrial data acquisition using an infrared laser beam and a fast scanning mechanism. The unique echo digitization and online waveform processing enables superior measurement performance and multiple return capability, even under adverse environmental conditions.

Benefits of Online Waveform Processing Technology:

- **Highly accurate ranging capability (6mm<)**
- **Ability to penetrate vegetation easily (can detect multiple targets within a single laser pulse)**
- **Capability to filter out noise for a clean and robust point cloud (pulse shape deviation)**
- **Scan under adverse atmospheric condition (fog, dust, rain, snow)**

Combined with RiSOLVE, the VZ-400 is the ultimate 3D scene capture solution for innovative police work in the field. Paired with the one-touch workflow of the *RIEGL* VZ-line terrestrial laser scanners, it enables fully automatic registration and colorization of scan data. This streamlined process is the fastest solution to acquire, register, and colorize outdoor 3D scan data.

The combination of the VZ-line terrestrial laser scanners and the RiSOLVE software has shown that the *RIEGL* forensic solution is proven, effective and cost efficient through the use of the scanners by the police force in the UK. An audit was done a year after police departments throughout the UK received a combination of the VZ-400 hardware and RiSOLVE software to determine the real world performance of the systems.

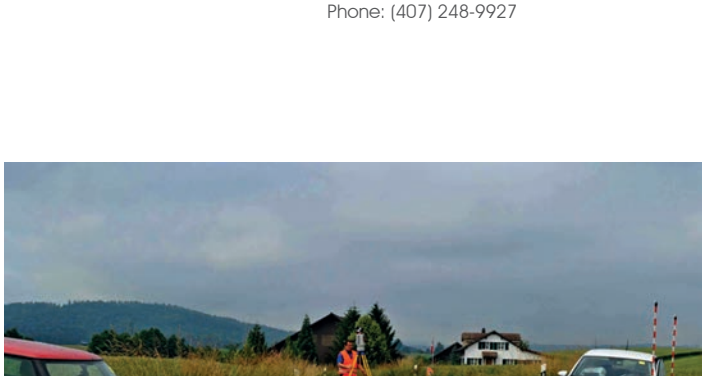
The audit found that on scenes where the VZ-400 was utilized, roads were opened an average of 44 minutes earlier than if the scene had been recorded with traditional technologies. In 2011, the UK Department for Transportation estimated that each hour of road closure caused economic losses of £50,000. In forensics, time is money and being able to open roads sooner means more money saved and less time needed!

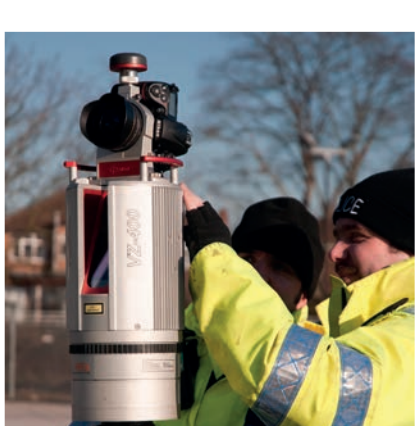
The use of the *RIEGL* terrestrial laser scanners, combined with RiSOLVE, is optimized for accident collision investigations. The state of the art hardware and software can be used to rapidly collect evidence at the scene of collisions, which helps to reduce the amount of time roads are closed, reduce lane closures, and minimize road congestion. Data collected from the scanners and processed through the specialized software can be used to produce high quality graphics and detailed plans of collision scenes to use in court cases.

Thank you for considering *RIEGL* instruments for your important work.
Please contact us with any questions that you may have.

Tan Nguyen
Forensics LiDAR Specialist
Email: tnguyen@rieglusa.com
Phone: (407) 248-9927

Shannon Trammell
Sales & Operations Manager
Email: strammell@rieglusa.com
Phone: (407) 248-9927





RIEGL VZ-400

**3D High Speed,
High Resolution Laser Scanner**

proven solution, worldwide use in police forces

- high speed data acquisition
- 300 kHz laser pulse repetition rate
- 5 mm accuracy, range more than 600 m
- online waveform procesing
- multiple target capability
- wide field-of-view, 100° x 360°

RIEGL VZ-400i

High Performance 3D Laser Scanner
Redefining Productivity

NEW

- ultra high speed data acquisition
- 1.2 MHz laser pulse repetition rate
- 5 mm accuracy, 800 m range
- real-time registration and processing
- cloud connectivity via Wi-Fi and 4G LTE
- user friendly touchscreen interface

RIEGL VZ-1000

**3D High Speed,
Long Range Laser Scanner**

very long range 3D laser scanner

- very high speed data acquisition
- 300 kHz laser pulse repetition rate
- 8 mm accuracy, range more than 1400 m
- online waveform procesing
- multiple target capability
- wide field-of-view, 100° x 360°

Typical Applications

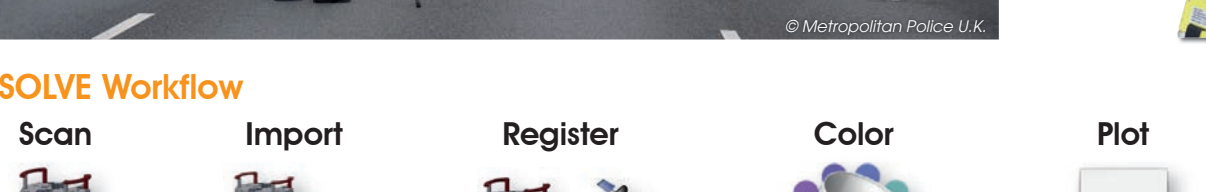
- Forensics
- Architecture & Facade Measurements
- As-Built Surveying
- Investigation
- Archeology and Cultural Heritage Documentation
- City Modeling
- Tunnel Surveying
- Civil Engineering
- Forestry, Research
- Monitoring
- Topography

RIEGL RiSOLVE combined with the *RIEGL* VZ-400

The Ultimate 3D Scene Capture Solution

Combined with the one-touch workflow of the *RIEGL* VZ-Line Terrestrial Laser Scanners, RiSOLVE enables fully automatic registration and colorization of scan data. This streamlined process is the fastest solution to acquire, register, and colorize outdoor 3D scan data.

RiSOLVE Workflow



RiSOLVE Features

- fully automatic registration
- fastest true-color scanning workflow
- convenient calibration, registration, and filtering tools
- one-touch solutions
- 2D measureable PDF plots
- photorealistic 3D scans

Automatic Registration Methods

- Direct Georeferencing
- GNSS Backsighting
- Backsighting
- Automatic Coarse Registration (ACR)

Watch the RiSOLVE video!
youtube.com/riegllms

Visit our website to read the data sheets, and get further information, also about the broad *RIEGL* Product Line.

Typical Applications

- Forensics
- Accident Investigation
- Architecture
- Rapid Deployment Scene Capture
- Emergency Management Planning
- Local Area Mapping
- Utility Asset Mapping
- City Modeling, Archeology

RiSOLVE & the *RIEGL* VZ-400 in Practice

Dave Foster, Senior Collision Investigator UK Police, relays his real-world experience, "Results to date suggest a registration time of around 1 minute per scan position, or even slightly faster, with minimal button pressing. Think of this workflow: Import scan data >press registration >*put kettle on* >*have biscuit* >registration completed >apply color >*finish cup of tea* >produce scale plan from scan data."

Foster continues: "I'm sure there are other tasks which could easily be completed as the registration/coloring process is under way, but that is the point; I'm doing other tasks and processing the data, without having to work on it directly. The relative simplicity of this workflow will make broader deployment of laser scanning in the field more acceptable."

Our Motivation - Saving Time in the Field

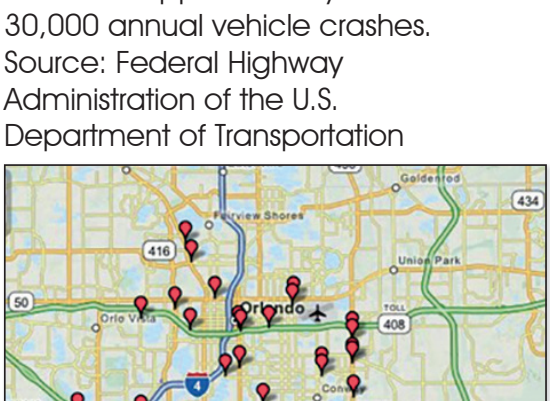
After serious road traffic collisions it is standard practice to accurately document forensic evidence in an objective and timely manner. This evidence recovery process can be stressful and time-consuming, especially in conditions where hundreds or thousands of vehicles are lined up and waiting.

The software is designed to utilize all of the measurement inputs from the *RIEGL* VZ-400 to enable a fully automatic workflow. Utilizing technological know how and real-world feedback from investigation officers and field experts, *RIEGL* has produced a one button solution for data processing. RiSOLVE accurately and automatically combines, adjusts, and colorizes the data collected in the field. The final results are a detailed point cloud and easy to use plot features which enable production of accurately scaled orthographic images exportable as measurable PDFs, TIFFs, JPGs and bitmaps. The output of RiSOLVE is a photorealistic 3D scan.

The average and peak hour cost per hour during delays on Oregon's I-route highways.

Orlando, Florida
Fatal Car Crashes & Road Traffic Accident Statistics for 2011

- Fatal Accident Count: 27= 27 hours of delay
- Estimated Overall Cost per Hour During Road Closures: $60,000/hr.-$70,000/hr.
- Total Estimated Loss for 2011 in the Orlando Area $1,350,000-$2,160,000
- In 2011 there were more than 5 million auto accidents with 32,367 fatalities. Source: AAA
- There are approximately 30,000 annual vehicle crashes. Source: Federal Highway Administration of the U.S. Department of Transportation



Estimates of the Cost of Unexpected Delay for Vehicles Operating on Oregon Highways

Location					Value of One Hour of Travel Time for all Vehicles				Peak Hour as % of Average
ID Number	ATR	Highway	Route	Mile Point	Average	Low	High	Peak Hour	
1	15-002	1	I-5	11,03	$ 14.400	$ 10.700	$ 16.500	$ 30.500	212%
2	15-019	1	I-5	28,33	$ 36.800	$ 29.800	$ 35.800	$ 74.800	203%
3	15-001	1	I-5	42,84	$ 28.500	$ 21.800	$ 29.400	$ 57.200	201%
4	17-001	1	I-5	64,2	$ 18.600	$ 13.000	$ 20.500	$ 40.700	219%
5	10-005	1	I-5	129,75	$ 26.600	$ 20.200	$ 28.200	$ 56.500	212%
6	10-007	1	I-5	145,39	$ 19.900	$ 14.400	$ 21.900	$ 43.200	217%
7	20-020	1	I-5	169,25	$ 21.300	$ 15.300	$ 23.500	$ 48.300	227%
8	22-016	1	I-5	214,56	$ 32.200	$ 23.800	$ 33.600	$ 70.600	219%
9	22-005	1	I-5	234,8	$ 49.900	$ 39.100	$ 50.300	$ 99.900	200%
10	03-011	1	I-5	281,2	$ 68.900	$ 53.800	$ 69.400	$ 133.900	194%
11	26-016	1	I-5	298,24	$ 106.400	$ 89.000	$ 99.700	$ 207.000	195%
12	26-026	1	I-5	300,37	$ 103.600	$ 84.800	$ 98.400	$ 187.200	181%
13	26-019	1	I-5	304,66	$ 103.200	$ 86.500	$ 98.200	$ 174.500	169%
14	26-004	1	I-5	307,97	$ 94.000	$ 77.700	$ 90.100	$ 165.600	176%
15	26-015	2	I-84	0,49	$ 102.900	$ 86.100	$ 97.000	$ 172.700	168%
16	26-014	2	I-84	3,35	$ 116.600	$ 98.200	$ 110.600	$ 201.700	173%
17	26-001	2	I-84	17,71	$ 22.800	$ 15.000	$ 26.800	$ 69.700	306%
18	33-001	2	I-84	75,93	$ 16.600	$ 11.300	$ 18.600	$ 43.100	260%
19	30-002	2	US730	193,7	$ 2.300	$ 1.600	$ 2.600	$ 4.900	213%
20	33-005	4	US197	10,14	$ 1.700	$ 1.200	$ 1.900	$ 4.800	282%
21	16-002	4	US97/US26	96,92	$ 10.200	$ 7.100	$ 11.100	$ 25.000	245%
22	09-020	4	US97	124,4	$ 22.100	$ 17.200	$ 21.900	$ 51.700	234%
23	09-003	4	US97	142,41	$ 16.300	$ 12.000	$ 17.700	$ 36.900	226%
24	18-006	4	US97	204,65	$ 4.300	$ 2.400	$ 5.600	$ 12.700	295%
25	18-019	4	US97	291,73	$ 3.500	$ 2.200	$ 4.200	$ 8.400	240%
26	09-007	4	US97	135,95	$ 32.000	$ 24.600	$ 32.500	$ 78.200	244%
27	09-009	4	US97	137,36	$ 29.100	$ 23.000	$ 30.000	$ 71.300	245%
28	11-007	5	OR19	6,15	$ 700	$ 500	$ 700	$ 1.900	271%
29	12-009	5	US26	175,79	$ 700	$ 400	$ 900	$ 2.500	357%
30	12-003	5	US26	131,4	$ 800	$ 500	$ 900	$ 2.800	350%
31	30-004	6	I-84	203,34	$ 12.600	$ 8.700	$ 13.400	$ 27.900	221%
32	01-011	6	I-84	286,65	$ 6.600	$ 4.300	$ 7.500	$ 17.900	271%
33	23-016	6	I-84	353,47	$ 8.500	$ 5.500	$ 9.800	$ 18.100	213%
34	23-014	6	I-84	376,98	$ 13.500	$ 9.500	$ 14.200	$ 26.300	195%
35	23-006	7	US20/US26	257,86	$ 3.700	$ 2.800	$ 3.800	$ 8.100	219%
36	23-013	7	US20	189,34	$ 1.100	$ 600	$ 1.500	$ 3.300	300%
37	13-003	7	US20	126,6	$ 1.900	$ 1.100	$ 2.400	$ 5.300	279%
38	09-005	7	US20	6,28	$ 2.200	$ 1.400	$ 2.400	$ 5.400	245%
39	30-021	8	ORE11	34,46	$ 10.700	$ 7.900	$ 10.700	$ 25.000	234%
40	04-004	9	US101	3,8	$ 5.100	$ 3.600	$ 6.500	$ 16.700	327%
41	04-001	9	US101	15,9	$ 10.100	$ 7.500	$ 11.800	$ 27.700	274%
42	29-001	9	US101	53,75	$ 4.700	$ 3.100	$ 6.100	$ 17.000	362%
43	21-007	9	US101	112,35	$ 12.000	$ 8.700	$ 14.100	$ 34.000	283%
44	21-008	9	US101	114,91	$ 18.400	$ 13.800	$ 20.800	$ 47.700	259%
45	21-009	9	US101	139,11	$ 13.800	$ 10.300	$ 15.600	$ 34.300	249%
46	06-001	9	US101	221,67	$ 6.000	$ 4.300	$ 7.200	$ 17.200	287%
47	06-009	9	US101	243,99	$ 11.200	$ 8.800	$ 11.700	$ 26.500	237%
48	06-004	9	US101	275,87	$ 4.900	$ 3.700	$ 5.400	$ 11.300	231%
49	08-005	9	US101	362	$ 6.800	$ 5.400	$ 7.500	$ 17.800	262%
50	08-009	9	US101	301,45	$ 2.100	$ 1.400	$ 2.900	$ 7.200	343%
51	31-003	10	OR82	1,74	$ 9.000	$ 7.200	$ 9.000	$ 23.200	258%
52	31-005	10	OR83	20,7	$ 1.500	$ 1.000	$ 1.900	$ 4.700	313%
53	01-010	12	OR86	37,55	$ 500	$ 300	$ 600	$ 1.500	300%
54	22-013	16	US20	19,05	$ 8.900	$ 7.200	$ 9.300	$ 21.200	238%
55	22-017	16	US20	51,47	$ 800	$ 500	$ 1.100	$ 4.100	513%
56	09-014	16	US20/OR126	93,19	$ 6.100	$ 3.500	$ 8.200	$ 23.900	392%
57	19-004	19	US395	120,83	$ 700	$ 400	$ 800	$ 2.100	300%
58	19-008	19	US395	157,43	$ 800	$ 500	$ 900	$ 2.200	275%
59	18-017	20	OR140	44,98	$ 900	$ 500	$ 1.000	$ 2.400	267%
60	15-007	21	OR66	6,61	$ 800	$ 600	$ 1.000	$ 2.400	300%
61	17-003	25	US199	41,32	$ 2.200	$ 1.300	$ 3.100	$ 8.800	400%
62	26-003	26	US26	14,36	$ 24.300	$ 20.500	$ 23.200	$ 52.900	218%
63	03-006	26	US26	44,87	$ 6.000	$ 4.400	$ 7.400	$ 25.800	430%
64	03-007	26	US26	57,99	$ 1.100	$ 600	$ 1.200	$ 8.200	745%
65	14-003	26	OR35	82,91	$ 800	$ 500	$ 1.000	$ 4.200	525%
66	02-003	27	OR34	53,89	$ 1.600	$ 1.300	$ 1.600	$ 4.200	263%
67	30-007	28	US395	16,87	$ 700	$ 400	$ 800	$ 2.200	314%
68	12-006	28	US395	89,8	$ 300	$ 200	$ 400	$ 1.100	367%
69	21-006	33	US20	34,02	$ 3.900	$ 2.700	$ 4.500	$ 11.500	295%
70	27-001	39	OR18	23,23	$ 14.100	$ 10.400	$ 15.300	$ 37.100	263%
71	07-001	41	US26	22,85	$ 2.100	$ 1.400	$ 2.500	$ 6.600	314%
72	28-001	42	US97	17,36	$ 2.200	$ 1.400	$ 2.600	$ 5.600	255%
73	26-002	47	US26	73,75	$ 100.100	$ 84.800	$ 94.800	$ 64.100	64%
74	34-001	47	US26	40,83	$ 5.200	$ 2.800	$ 7.500	$ 23.700	456%
75	13-001	48	US395	66,66	$ 400	$ 200	$ 500	$ 1.300	325%
76	25-007	52	OR74	37,83	$ 1.100	$ 800	$ 1.100	$ 2.900	264%
77	16-006	53	US26	113,29	$ 5.400	$ 3.800	$ 6.200	$ 16.500	306%
78	26-005	61	I-405	0,6	$ 70.200	$ 59.300	$ 66.400	$ 130.800	186%
79	26-027	61	I-405	3,05	$ 82.500	$ 69.000	$ 77.600	$ 167.300	203%
80	20-005	62	OR126	43,86	$ 4.900	$ 3.600	$ 5.600	$ 14.000	286%
81	03-016	64	I-205	1,27	$ 61.400	$ 50.200	$ 59.200	$ 116.600	190%
82	01-012	71	ORE7	48,4	$ 1.000	$ 600	$ 1.300	$ 5.300	530%
83	24-020	140	OR219	31,88	$ 1.900	$ 1.400	$ 2.200	$ 6.900	363%
84	24-015	162	OR22	51,3	$ 3.400	$ 1.900	$ 4.700	$ 16.900	497%
85	24-004	162	OR22	2,82	$ 18.500	$ 14.500	$ 19.400	$ 44.700	242%
86	11-004	300	OR206	41,74	$ 100	$ 100	$ 200	$ 600	600%
87	30-012	330	OR204	0,12	$ 900	$ 600	$ 1.100	$ 3.000	333%
88	13-007	442	OR78	1,7	$ 1.100	$ 800	$ 1.200	$ 2.800	255%
89	23-012	456	US95	91,48	$ 1.200	$ 600	$ 1.400	$ 3.400	283%
90	24-001	1E	OR99E	34,16	$ 7.400	$ 6.100	$ 7.200	$ 19.500	264%
91	36-004	1W	OR99W	21,81	$ 24.700	$ 20.100	$ 23.800	$ 51.200	207%
92	36-005	1W	OR99W	47,15	$ 4.400	$ 3.400	$ 4.200	$ 11.000	250%
93	05-006	2W	US30	53,33	$ 7.600	$ 5.600	$ 8.500	$ 20.500	270%

		Average	Peak
	Total	$ 1.755.500	$ 3.551.800
Averages all		$ 18.876	$ 38.191
Comparison for HAJDT figures	I routes only Total	**$ 1.225.000**	**$ 2.382.000**
	Average	**$ 49.000**	**$ 95.280**

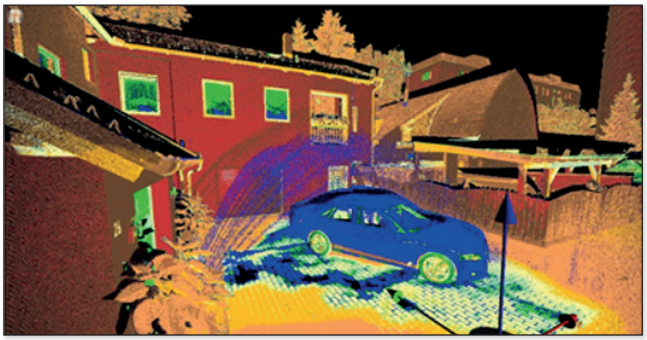
With an IP rating of 64 and equipped with Online Waveform Processing technology, scanning can be done in harsh conditions such as extreme temperatures, rain, fog, snow.

scanning in the rain

applying filter
(deviation and reflectance filter)

removing the rain

wet black vehicle
(image from DLRS camera)



wet black vehicle
(image from laser data, shown in reflectance)

UNAVCO's RIEGL VZ-400 terrestrial laser scanner in action, with the Mount Erebus Volcano Observatory scanning the Mount Erebus lava lake

Designed for demanding field use:
RIEGL VZ-1000 scanning a Hawaiian lava field

Operating in extreme temperature

Protection Class	IP64, dust- and splash-proof
Temperature Range	
Storage	-10°C up to +50°C
Operation	0°C up to +40°C: standard operation
Low Temperature Operation*	-20°C: continuous scanning operation if instrument is powered on while internal temperature is at or above 0°C and still air
	-40°C: scanning operation for about 20 minutes if instrument is powered on while internal temperature is at or above 15°C and still air

* Insulating the scanner with appropriate material will enable operation at even lower temperatures.


© Stadtpolizei Zürich


Draughton

» **RiSOLVE** enables fully automatic registration and colorization of scan data.

» The stream-lined process of **RiSOLVE** is the fastest solution to acquire, register, and colorize outdoor 3D scan data.

» **RiSOLVE** enables rapid turnaround of critical information with additional tools for filtering, scene animation and measurements.

» **RiSOLVE** takes the complexity out of the registration process by utilizing positioning information provided by sensors integrated into VZ-Line scanners.

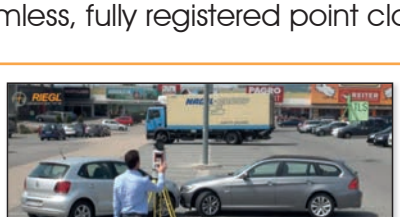
» **RiSOLVE** enables a final, fine adjustment of all scans to produce a seamless, fully registered point cloud.

Workflow: 5 easy steps

Scan

- 20+ million measurements
- 5 high-resolution images
- precise inclination data
- GNSS position
- compass bearing

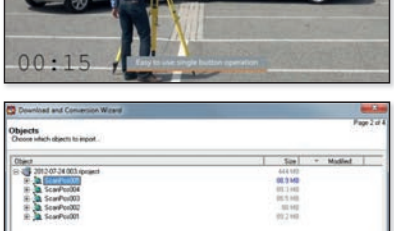
3 minutes per position



Import

- download project
- import from USB flash drive
- create project structure

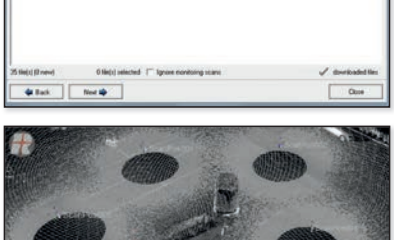
1 minute per position



Register

Automatic Registration:
1) position estimation via:
inclination, GPS & compass
2) course registration
3) fine adjustment

less than 1 minute per position

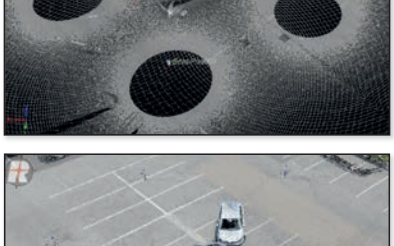


Color

One-Click Color:

- utilizes calibrated images
- automatically adjusts frame
- colorizes point cloud

less than 1 minute per position



Plot

- automatically selects region
- exportable to PDF
- plot to image

Technology Highlights

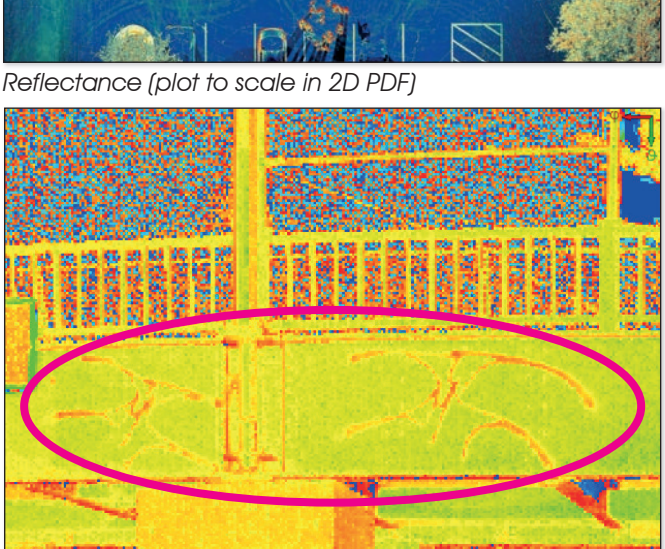
- » not range dependent reflectance
- » easily identify road markings and objects
- » filter through reflectance values
- » easily identify blood spatter
- » highlight and identify hidden markings behind painted surfaces

Reflectance

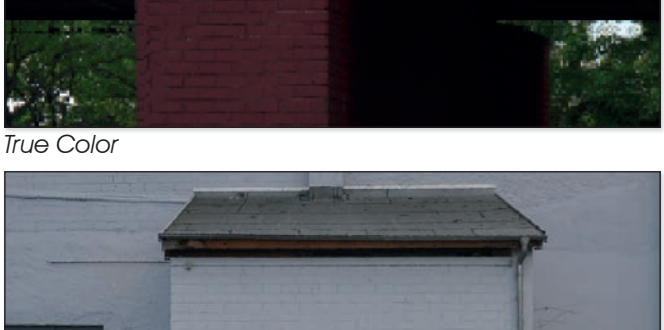
Reflectance (user defined color scheme)

Reflectance (plot to scale in 2D PDF)

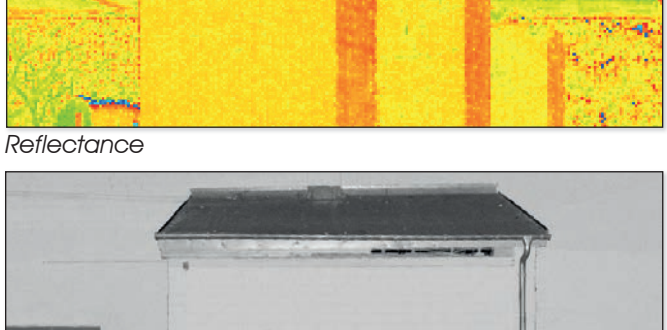
True Color



Reflectance



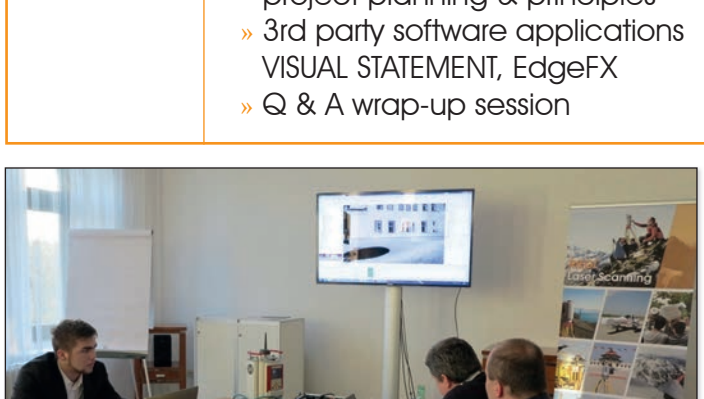
True Color

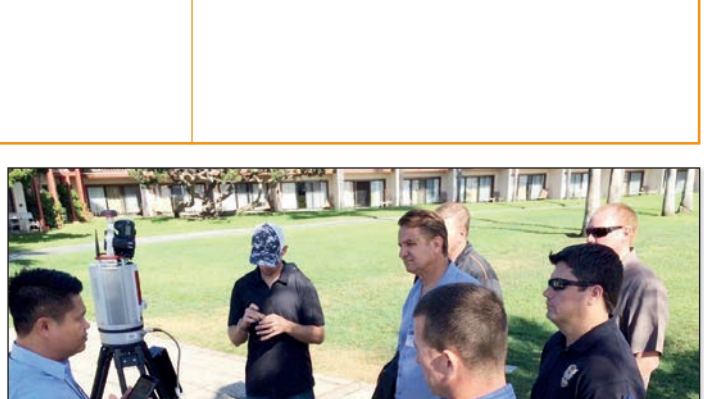


Reflectance

Trainings are always tailored to specific needs. This is just an example agenda.

Date	Training Session	Notes
Day 1		
	» Introductory presentations » Equipment parts identification » Hardware configuration » Introduction to RiSOLVE » Introduction to RiSCAN PRO » Initial in house scanning » Basic scanning workflow using RiSCAN PRO for indoor scene » Basic scanning workflow using RiSOLVE for outdoor scene	Training Room
Day 2		
	» Outside scanning » RiSOLVE post processing workflow » Registration » Targets » Multi-Station Adjustment (if purchased)	Outside Scanning Wear comfortable clothing Training Room
Day 3		
	» Filtering » QA/QC » Combining datasets » Data Export techniques » Strategy Planning – project planning & principles » 3rd party software applications VISUAL STATEMENT, EdgeFX » Q & A wrap-up session	Training Room





RIEGL USA
Complete Care Program Support Services

RIEGL develops and manufactures innovative LiDAR hardware systems and supporting software to offer a truly integrated solution with cutting edge, user-friendly workflow management. *RIEGL* USA will give you the best return on your investment by providing outstanding service, support and valuable expertise.

WARRANTY & MAINTENANCE (Included in Price)

- Three (3) year extended hardware warranty
  (Warranty is governed by *RIEGL* USA's terms and conditions, which can be found at **http://www.rieglusa.com/general-terms-conditions.html)**
- One (1) regular system maintenance to be performed at the end of 2nd year of ownership or after 2,000 scan hours, whichever is earlier
- Two (2) years RiSOLVE software maintenance covering years 2&3
  (Each *RIEGL* USA extended software maintenance includes email and telephone support for 12 months, a renewal license certificate and software updates for 12 months)

SUPPORT (Included in Price)

- Lifetime unlimited email and phone support for *RIEGL* USA certified operators
  (Please note: Customer may be required to purchase hardware or software maintenance and download updates to achieve desired resolution.)

RIEGL USA offers a competitive and comprehensive industry leading support option. Our international support partners in Austria, Japan, China and South America, as well as in the United States, can reach almost any destination in a number of languages with a wide range of support options. Our technical specialists located abroad and throughout North America can provide these regional and worldwide support services.

Phone or Email:

Comprehensive technical support is only a phone call or email away. Your problems, concerns, and questions will be quickly handled by a member of the *RIEGL* USA support staff. Our highly trained and experienced Technical Support Team is available for the lifetime of the ownership of your *RIEGL* products.

Call: (407) 248-9927 **Email: support@rieglusa.com**

Web:

In addition to our phone and email support services, we have a *RIEGL* Downloads area offering an online database of literature, manuals, white papers, technical support documents, FAQ's, newsletters and instant access to software updates and upgrades for your *RIEGL* scanner and provided software.

You must register here to access the files and literature:
http://www.riegl.com/members-area/registration

Expert support options for onsite support are also available in person upon request.

TRAINING & SUPPORT CENTERS

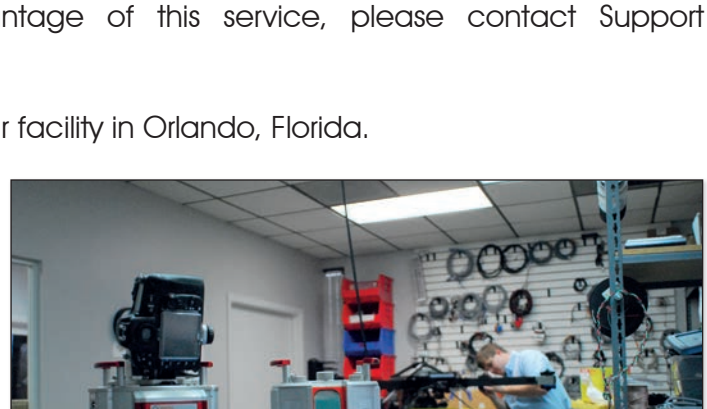
Training Solutions:
RIEGL USA offers highly customizable and regularly scheduled training classes; workshops with hands-on training and software training, as well as documented materials for reference. Our highly skilled trainers are available to discuss your training needs. We offer large and small group training and guarantee that after one session of training with our staff, you will be able to complete your projects with ease, speed, and productivity.

Manuals:
Retrieve user manuals, quick start guides, programming/software manuals, accessory manuals, and other supplemental documentation regarding your *RIEGL* Scanner here*:
http://www.riegl.com/members-area

*Please note that you must be registered to access this area.

Service & Repair:
RIEGL USA offers a low cost recommended annual service check and camera recalibration on all instruments at our facility. To take advantage of this service, please contact Support at **support@rieglusa.com**.

NEW *RIEGL* USA has an authorized service & repair facility in Orlando, Florida.



Testimonials:

COUNTY OF SAN DIEGO

DEPARTMENT OF PUBLIC WORKS

INTERDEPARTMENTAL CORRESPONDENCE

April 15, 2015

To: Whom it may concern

From: Ed Phillips, B.Sc.Eng.
Accident Reconstruction Specialist
CSD Traffic Engineering Section

Re.: **Riegl VZ400 Terrestrial Laser Scanner**

The County of San Diego purchased a Riegl VZ 400 terrestrial laser scanner in July 2014 to replace a Leica TCRA 1103 + robotic reflectorless total station. I am the primary user of both devices, and my function is to respond to traffic collisions that occur on the 2,000-miles of roads owned and maintained by the County of San Diego. Historically on scene, we would set up lane closures or detours and collect points of evidence, roadway geometry and traffic engineering features. Typically we could collect an average of 100-data points per hour, with scenes averaging 300-400 points. This resulted in an impact to normal traffic flows of three to four hours once documentation began. This did not include set up and take down time of the closures (signs and cones) which added to potential exposure time to workers of a half-hour or more. Employing the Riegl laser scanner to scenes has resulted in a diminishment of scene documentation time to usually no more than an hour. In addition, cones, diversions and closures are the exception, not the norm. Traffic flows are stopped for 5-minute periods and allowed to flow while the scan positions are re-located. This has greatly reduced traffic delays and disruptions, and employee exposure to potential in-road hazards.

The scanner is capable of sending and receiving over 4-million data points per minute, and scan times with photography taking about 5-minutes per scan position. The system is capable of scanning and collecting images in low-light and low setting sun situations as well as full sun situations. The device is used for criminal and civil matters, and has been accepted without opposition in demonstrative court matters.

Vehicle documentation was previously performed off site using photogrammetry techniques. This was a one to two hour process, which didn't include 4 to 8-hours of in office post-processing of data. Documentation is now performed by laser scanning. The process takes about ½-hour in the field with automated post-processing rarely taking more than an hour.

I share outputs with law enforcement personnel as a scale ortho-rectified 2d jpeg images or as a 3d image captures or files.

I would be happy to discuss techniques or practicalities further with any interested party.

Ed Phillips, BA, BScEng
Accident Reconstruction Specialist
County of San Diego
Department of Public Works - Traffic Engineering
858-699-0510

CONTROLPOINT

ControlPoint Surveying uses a Riegl-VZ400 for the past few years. We find their service efficient, competent and reliable. This provides ControlPoint Surveying with a competitive edge in delivering professional services to our clients. We highly recommend Riegl USA and the VZ-400.

Kevin Yeh - PointCloud Operator

ControlPoint Surveying, Inc.

Oahu 1150 South King Street, Suite 1200, Honolulu, Hawaii 96814 Tel: 808 591-2022 Fax: 808 591-8333
Maui 1129 Lower Main Street, Suite 102, Wailuku, Hawaii 96793 Tel: 808 242-9641 Fax: 808 244-9220

Testimonials:

April 15th, 2015

Riegl USA
7035 Grand National Dr.
Orlando, FL 32819
Attention: Tan Nguyen

Dear Mr. Nguyen,

Kiewit Engineering & Design Co. (KED) became involved in laser scanning in 2006 with the purchase of a Leica ScanStation2. Always striving to improve safety, quality and to reduce cost, the decision was made to purchase a faster and more efficient scanner.

In 2012 Kiewit performed a side by side comparison between the Riegl VZ-400, the Faro Focus 3D, and our operating Leica ScanStation2. The attached sheet proved the Riegl VZ-400 was the most effective scanner for our requirements of time savings, quality, accuracy and range. The data acquisition time, was greatly reduced due to the speed and range the scanner, thus allowing us to collect more data than ever before. Riegl's processing software, RiScan Pro, had simple and easy to use features that ensured our data was processed correctly with options to effectively QC/QA the collected data in the field.

After working with the Riegl VZ-400 for the last 3 years I can say that it was money well spent. The available tools, guidelines and user manuals that Riegl offers, have been invaluable in training our staff. Riegl's support staff also ensures that they are available to assist and answer any questions that we have, which was not something we could easily get with our previous scanner.

The bottom line is that the Riegl VZ-400 is highly effective at capturing large amounts of data to be processed quickly and accurately. This leads to significant time savings in the field and office processing. Kiewit's experience with the VZ-400 and Riegl as a company has been overwhelmingly positive. It has led to many successful projects, delivering a high quality product in a short amount of time while saving our client's money.

Eric Graham
Mechanical Designer
Chief Scan Technician

Kiewit Engineering & Design Co.
9401 Renner Boulevard, Lenexa, KS 66219
(913) 928-7309 (913) 708-1789 cell
(913) 689-4309 fax
eric.graham@kiewit.com

KIEWIT ENGINEERING & DESIGN CO.
9401 Renner Blvd., Lenexa, KS 66219 Page 1 of 2

Kiewit

Leica Scan Station 2	Faro Focus 3dr	Riegl VZ-400 Laser Scanner
Scan distance 984' with 2mm" accuracy	Scan distance 82' with 2mm" accuracy	Scan max distance 1968' with 2mm" accuracy or better.
Up to 50,000 points/sec Varies by density, distance and field-of-view settings	Up to 976,000 points/sec Depends on density, distance and field-of-view	Up to 144,000 points/sec Varies by density settings
Up to 15 scans acquired on average a day.	Up to 50+ scans acquired on average a day.	Up to 50+ scans acquired on average a day.
1 hour+ average scan time.	3-4 minute average scan time.	2.5 minute average operating scan time.
3 week average turn-around time for deliverables	2 week average turn-around time for deliverables	1 week average turn-around time for deliverables
Laser Class II – safe for average operation without continuous direct ocular exposure.	Laser Class III – safety goggles should be worn.	Laser Class I – near infrared, no ocular hazard, safest available laser class on the market.
No GPS, internal camera; honeycomb photo format with little to no exposure adjustment settings for dark areas.	No GPS, internal 2.0 Mega pixel camera, No flash for low light scans	Internal GPS, external Nikon D70 6.24 Megapixel camera with flash and external flash mount.

KIEWIT ENGINEERING & DESIGN CO.
9401 Renner Blvd., Lenexa, KS 66219 Page 2 of 2

References:

San Diego Dept. of Public Works
Ed Phillips – Traffic Reconstruction Specialist
Ed.phillips@sdcounmty.ca.gov
San Diego, CA 92123

United States Secret Service (USSS)
Dan Livecchi – LiDAR Project Coordinator
Daniel.livecchi@usss.dhs.gov
Washington, DC

National Police of the Netherlands Central Unit
Central Forensic Service Center
Toine Voeten
Forensic Reconstruction Specialist
toine.voeten@politie.nl
Driebergen (U)

Kantonspolizei Zürich
Dienstchef Unfallfotodienst
Adj Heinz Schär
www.kapo.zh.ch

Stadtpolizei Zürich
Unfalltechnischer Dienst
Abteilung Spezialvermessung
www.stadtpolizei-zuerich.ch

United States Army Criminal Investigation Laboratory
Natalia Harmsen –
natalia.harmsen1@us.army.mil
Forest Park, GA

Federal Bureau of Investigation (FBI)
Steven Jameson – Supervisor Technical Design and Documentation Program
Steven.jameson@ic.fbi.gov
Washington, DC

3D Laser Mapping Crash Investigations Help Reduce Traffic Congestion

June 21, 2011

The use of laser scanners to collect vital data for crash investigations is set to drive down the £1bn ($1.6bn) annual cost of congestion caused by collisions on UK motorways. An announcement by the UK Roads Minister Mike Penning of a £3 million fund for police forces to purchase laser scanning technology ensures Nottingham based 3D Laser Mapping will continue to lead the way having supplied one of the UK's largest Road Death Investigation units with state of the art laser scanners.

In regular use, the Riegl VZ-400 laser scanner has been proven to reduce the time spent collecting evidence at the scene, can be operated in all conditions and is being used to produce high quality graphics and detailed plans of collision scenes for use in court.

The Riegl VZ-400 laser scanner supplied by 3D Laser Mapping has been proven to provide a significantly greater level of detail and colour compared to other laser scanners and can be used during the day, evening in low light conditions, and at night. The VZ-400 was also significantly faster than other devices. Comparison of the Riegl with total station surveying, widely used by Police Forces across the country, identified an onsite time saving in the region of 50 per cent. This can in turn be converted into a reduction in road closure times by an average of 1.5 hours.

Dr Graham Hunter, Managing Director of 3D Laser Mapping commented, "Laser scanning has been proven to offer significant advantages over more traditional survey techniques for crash investigation. Using the Riegl VZ-400 it is possible to collect more data, of a higher level of accuracy, in a shorter period of time and in adverse conditions." He continued, "This directly translates into a reduction in road closure time which in turn can be converted into a multi million pound saving for the UK economy."

The VZ-400 utilises unique echo digitisation and online waveform analysis to achieve superior performance and accuracies of measurement, even under adverse weather conditions. Achieving accuracies of 5mm at ranges of up to 600 metres (an increase of 100 metres on earlier models) the VZ-400 can measure up to 122,000 points per second with a 100 x 360-degree field of view. The evaluation of multiple targets combined with a reliable, robust and lightweight construction makes the VZ-400 ideally suited to civil engineering, city modelling and architectural projects, for example.

June 18, 2014

Procurement of Laser Scanning Devices for the Four Welsh Police Authorities

The Minister for Economy, Science and Transport has agreed to the procurement of four 3D Scanners that will aid Welsh Police Forces in investigating serious collisions on the Motorway and Trunk Road Network.

Date of decision:

30 May 2014

Statement of information:

The Minister for Economy, Science and Transport has been asked to agree funding for the provision of 3D Scanners for use by the four Welsh Police Forces in investigating serious collisions on the Motorway and Trunk Road Network.

The relevant legal powers are Section 60 of the Government of Wales Act 2006 (which permits the Welsh Ministers to do anything that they consider appropriate to achieve the object of promoting or improving the economic, social and environmental well-being of Wales) and Section 71 (which permits Ministers to do anything which is calculated to facilitate, or is conducive or incidental to, the exercise of any of their other functions). Those powers are powers of the Welsh Ministers.

Metropolitan Police Invests in Laser Scanning Technology to Reduce Congestion

Traffic congestion caused by collisions on London□s roads is set to be significantly reduced following the delivery of two additional state of the art laser scanners. Purchased by the Metropolitan Police the RIEGL laser scanners will be used to rapidly collect vital evidence at the scene of collisions. Data collected by the scanners is used to produce high quality graphics and detailed plans of collision scenes for use in subsequent enquiries and court cases. The Metropolitan Police already have three laser scanners in regular use by Collision Investigators.

The Metropolitan Police was one of the first forces in the UK to adopt this technology and undertook extensive trials before purchasing the RIEGL laser scanners from 3D Laser Mapping.

□Before committing budget and resources, to laser scanning in general and this device in particular, it was important that we fully understood the benefits it afforded,□ commented Sergeant Dave Kingston Senior Collision Investigator of the Metropolitan Police Road Death Investigation Unit. □An independent pilot study concluded the RIEGL laser scanners delivered an onsite time saving of 50 per cent compared to traditional total station surveying and collected thirty per cent more data than other scanners we trialled, helping us cut road closure times by up to 90 minutes.□

□This latest purchase means we now have laser scanning capability within each of the Investigation Units,□ continued PS Kingston, □meaning every collision we respond to can be processed to obtain highly accurate measurements of the entire scene in the shortest possible time.□

The RIEGL VZ-400 laser scanners purchased by the Metropolitan Police have been proven to provide a significantly greater level of detail and colour compared to other laser scanners and can be used during the day, even in low light conditions, and at night. The VZ-400 utilises unique echo digitisation and online waveform analysis to achieve superior performance and accuracies of measurement, even under adverse weather conditions. Achieving accuracies of 5mm at ranges of up to 600 metres the VZ-400 can measure up to 122,000 points per second with a 100 x 360-degree field of view.

24 Sonntags Blick Aktuell

Raser, Mörder, Explosionen – dank High

Das 3D-Auge des Gesetzes

Wie weit flogen die Trümmer des Garagentors? Mit der Antwort können die Ermittler den Explosionsherd genau berechnen. Für dieses Modell der Brandruine waren sechs Scans nötig. Aufwand: 20 Minuten.

Sie sehen alles und vermessen auch kleinste Teile millimetergenau: die neuen Hightechkameras der Schweizer Polizei.

VON LEO FERRARO

In der Nacht auf den 7. Januar reisst ein gewaltiger Knall die Einwohner des Dörfchens Marsens FR aus dem Schlaf. Die Explosion verwandelt das Haus der vierköpfigen Familie M. in einen Trümmerhaufen.

Mutter Chantal (44) stirbt unter 150 Kubikmeter Schutt. Teile ihres Ford Kuga und des Garagentors fliegen mehr als hundert Meter weit weg.

Heute ist der Ablauf des Dramas geklärt. Gemäss Kantonspolizei Fribourg lagerten Farbkübel neben der Ölheizung. Darin entwickelten sich explosive Dämpfe, die in den Brenner des Heizkessels gelangten: bum!

Für ihre Ermittlungen stand der Polizei erstmals bei einem Explosionsunglück ein Hightechscanner zur Verfügung. Das Gerät erlaubt, den gesamten Schadenplatz exakt zu vermessen und dreidimensional abzubilden. **Dabei werden selbst Trümmerteile von der Grösse eines Einfränklers millimetergenau erfasst.**

In Marsens hat das «3D-Auge» die Polizei rasch zur Unglücksursache geführt. Weil das Gerät genau messen kann, wie weit welches Trümmerteil geschleudert wurde, lässt sich nicht nur die Stärke, sondern auch der genaue Herd der Explosion berechnen.

Dienstchef Heinz Schär (57) mit dem RIEGL LASER SCANNER: Er sieht 600 Meter weit. Seine Software rechnet beliebig viele Scans mehrerer Standorte zu einem dreidimensionalen Modell des Unfall- oder Tatgeschehens zusammen.

In der Schweiz verfügen neben der Kantonspolizei Fribourg nur die Kapo Bern, St. Gallen sowie die Kantons- und Stadtpolizei Zürich über diese Wunderwaffe der Beweissicherung. Eingesetzt werden die Geräte bei Ereignissen mit besonders grossen oder komplexen Schadensbildern: **Massenkarambolagen, Flugzeugabstürze, Brände, Arbeitsunfälle und schwere Verkehrsunfälle.**

Wie bei der Frontalkollision auf der A4 bei Winterthur ZH am 3. Juli. Damals krachte ein 30-jähriger Mann frontal in ein entgegenkommendes Fahrzeug. «Für die Beweisaufnahme und -sicherung ist die neue Technik ein Quantensprung», sagt Heinz Schär (57). Er ist Dienstchef des

SONNTAGSBLICK 27. Januar 2013 Sonntags Blick 25

tech löst Polizei ihre Fälle schneller

Unfallfotodienstes der Kantonspolizei Zürich, die als erste Polizeieinheit der Schweiz den 3D-Scanner standardmässig einsetzt. **Seit dem Mai 2012 kam das Gerät bereits 141-mal zum Einsatz.**

«Früher mussten wir Unfallspuren von Hand vermessen. Oft blieben darum Hauptverkehrsstrassen stundenlang gesperrt», sagt Schär. Mit dem 3D-Scanner sei die Beweisaufnahme wesentlich schneller abgeschlossen.

Und so funktioniert das Hightechgerät: Der Scanner dreht sich 360 Grad um die eigene Achse und hat einen Öffnungswinkel von 100 Grad. **Er sendet einen augensicheren Laserstrahl aus und rechnet das reflektierte Echo in Entfernung um.**

Pro Sekunde kann der Scanner auf diese Weise 122 000 Messpunkte erfassen. Indem die Software mehrere Aufnahmen von verschiedenen Standorten voll automatisch zusammensetzt, entsteht eine dreidimensionale Animation. Schär: «Die Ermittler können den Tat- oder Unfallort am Computer virtuell begehen und so den Ablauf exakt rekonstruieren.»

Das 3D-Auge des Gesetzes wird auch helfen, Kriminalfälle zu lösen. **Künftig soll das Gerät auch bei Tatorten von Gewaltdelikten häufiger zum Einsatz kommen,** um Spurenbilder millimetergenau zu vermessen.

«Aufgrund der hohen Präzision haben diese Aufnahmen eine grosse Beweiskraft», erklärt Schär. Und die Sicherung von vergänglichen Spuren, etwa Blut, lasse es auch zu, bei Bedarf lange nach dem Ereignis auf die Beweismittel zurückzugreifen. ●

Police forces given £2.7m to spend on 3D scanning technology

The government has awarded 27 police forces a £2.7m fund for 3D scanning technology to be used to examine motorway crash sites.

The Department for Transport (DfT) hopes that the technology will shorten motorway closures by capturing a 3D image of a crash site as oppose to investigators surveying several sections of the same scene.

Further reading

- BETT: 3D and gaming to make education more engaging
- Data consolidation case study: British Transport Police
- Interview: Ian Campbell, CIO, Transport for London

The 3D image can then be viewed remotely on a computer screen to allow investigators to take measurements and examine other evidence.

The roll out of 3D laser scanning technology is part of a government initiative called Clear (collision, lead, evaluate, act, re-open), which is aimed at reducing delays caused by incidents in order to keep traffic moving.

Police forces and the National Policing Improvement Agency have also made an unspecified additional contribution to the fund, which will allow them to purchase 37 3D scanners.

Roads minister Mike Penning emphasised the importance of the technology: "The £2.7m DfT funding award will see 3D laser scanners rolled out quickly where they are needed most. This will benefit drivers by reducing incident clear-up times by 39 minutes on average."

Use *RIEGL's* fully integrated Airborne and Mobile Laser Scanning Systems for expanded coverage in large and remote scenes. Additionally combined with RBG or IR cameras, RiCOPTER and VP-1 can produce highly accurate and very dense point clouds from the air. For mobile data acquisition from moving platforms, VMZ, VMQ-1HA, and VMX-1HA offer various possibilities for fast but convenient acquisition of scan and image data.

RIEGL RiCOPTER with *RIEGL* VUX-SYS integrated

Remotely Piloted Aircraft System for Unmanned Laser Scanning (ULS)

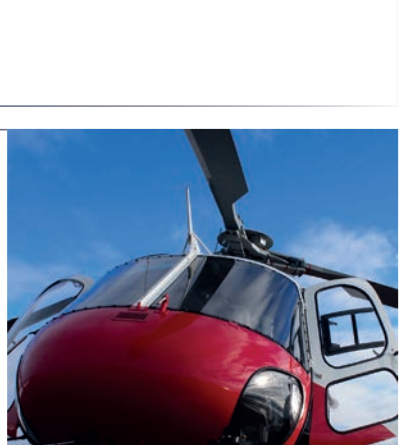
- robust and reliable airborne scanner carrying plattform
- full mechanical and electrical integration of sensor system components with aircraft fuselage
- carbon fibre main frame, foldable propeller carrier arms, and shock-absorbing undercarriage for stable flight, landings and comfortable transportation
- **max. payload (batteries & sensor load) up to 16 kg**
- **Maximum Take-Off Weight (MTOW) < 25 kg**

RIEGL VUX-SYS

- complete miniaturized ALS system
- *RIEGL* VUX-SYS (comprising *RIEGL* VUX-1UAV LiDAR sensor, IMU/GNSS unit with antenna, control unit, and optional cameras) integrated
- field of view up to 230°
- range accuracy 10 mm • eyesafe Laser Class 1

RIEGL VP-1 with *RIEGL* VUX-SYS integrated

Helipod for Airborne Laser Scanning (ALS)



- robust and reliable airborne scanner carrying plattform
- full mechanical and electrical integration of sensor system components into aircraft fuselage
- total weight approx. 19 kg, area exposed to wind 0,114 m^2
- *RIEGL* VUX-SYS (comprising *RIEGL* VUX-1LR Long Range LiDAR sensor, IMU/GNSS unit with antenna, control unit, and digital camera) integrated
- field of view up to 330°
- range accuracy 15 mm • eyesafe Laser Class 1

Typical Applications

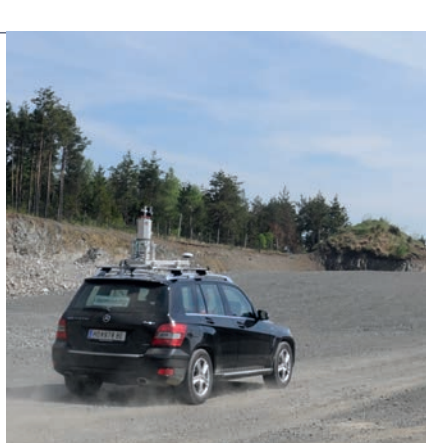
- Accident Investigation
- Emergency Management Planning
- Topography in Open-Cast Mining
- Terrain and Canyon Mapping
- Surveying of Urban Environments
- Construction-Site Monitoring
- Power Line, Railway Track, and Pipeline Inspection
- Tunnel Surveying
- Archeology and Cultural Heritage Documentation
- Mining

RIEGL VMZ

Hybrid Mobile Laser Mapping System

from static to mobile scanning in a few steps

- fully integrated IMU/GNSS unit to support *RIEGL* VZ-400, VZ-1000 and VZ-2000 scanners for mobile (kinematic) data acquisition
- quick switch from mobile to terrestrial applications, and vice versa, without losing stability of system calibration
- image acquisition with fully integrated NIKON® DSLR camera
- panoramic camera systems such as POINT GREY Ladybug5® additionally available
- easy system operation and data processing with ***RIEGL's* standard software packages** for static and mobile scanning applications

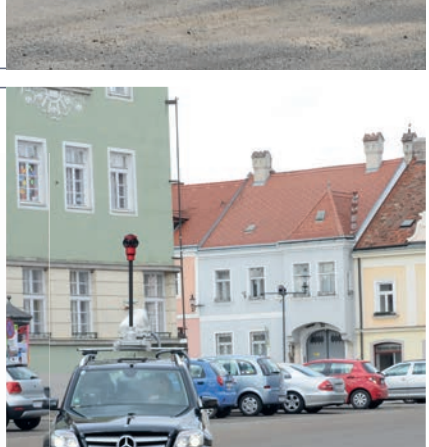


RIEGL VMQ-1HA

NEW

High Speed,
Single Scanner Mobile Mapping System

- up to 1,000,000 measurements/sec
- up to 250 scan lines/sec
- 5 mm accuracy, 3 mm precision
- 360° vertical field of view
- eyesafe operation at Laser Class 1
- interfaces for up to 4 optional cameras
- multiple swivel position of the measuring head



RIEGL VMX-1HA

NEW

High Speed, High Performance
Dual Scanner Mobile Mapping System

- up to 2,000,000 measurements/sec
- up to 500 scan lines/sec
- 5 mm accuracy, 3 mm precision
- 360° vertical field of view
- eyesafe operation at Laser Class 1
- optional camera system with up to 6 cameras
- aerodynamically-shaped protective cover

Typical Applications

- As-Built Surveying
- GIS Mapping and Asset Management
- Open-Pit Mine Surveying
- City Modeling
- Road Surface Measurement
- Archaeology
- Facade Modeling

RIEGL USA Inc.

7035 Grand National Drive,
Suite 100 Orlando, Florida 32819
USA

Phone: (407) 248-9927
Fax: (407) 248-2636
Email: info@rieglusa.com

www.rieglusa.com

RIEGL Laser Measurement Systems GmbH, Austria

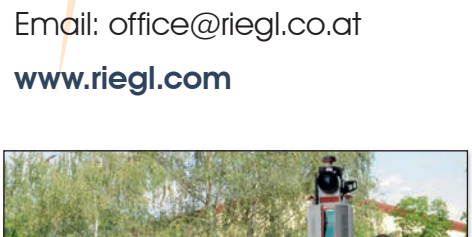
Headquarters:
Riedenburgstrasse 48, 3580 Horn, Austria

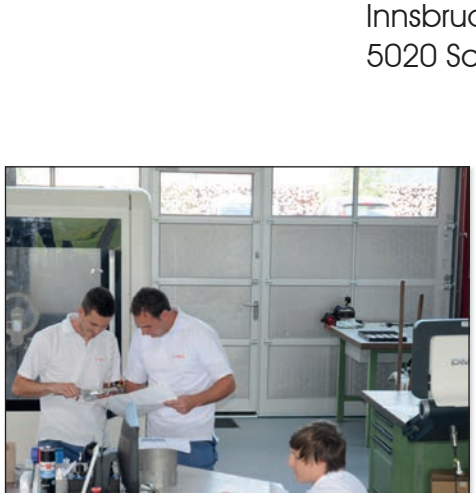
Phone: +43 2982 4211
Fax: +43 2982 4210
Email: office@riegl.co.at

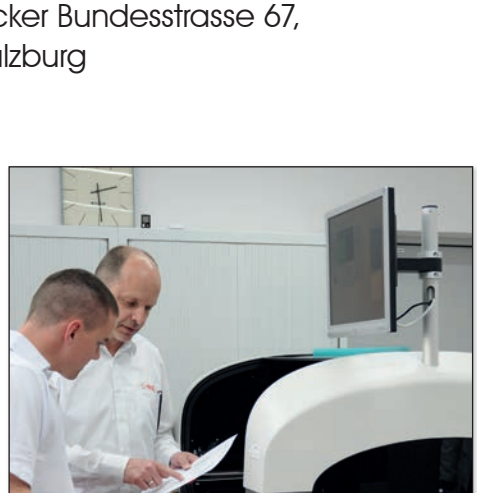
www.riegl.com

Vienna Office:
Millennium Tower,
Handelskai 94-96, 1200 Vienna

Salzburg Office:
Innsbrucker Bundesstrasse 67,
5020 Salzburg







RIEGL Worldwide

RIEGL's headquarters are located in Horn, an attractive small town in Lower Austria around 85 km northwest of the Austrian capital Vienna, with good transport connections, right in the heart of Europe. Sales, training, support and service are provided worldwide by the headquarters in Austria, by the *RIEGL* main offices in the USA, Japan, and in China, and by dozens of distributors and regional offices in Europe, North and South America, Asia, Australia, and Africa.

RIEGL LMS GmbH
Horn, Austria
office@riegl.co.at

www.riegl.com

RIEGL USA Inc.
Orlando, Florida
info@rieglusa.com

www.rieglusa.com

RIEGL China Ltd.
Beijing, China
info@riegl.cn

www.riegl.cn

RIEGL Japan Ltd.
Tokyo, Japan
info@riegl-japan.co.jp

www.riegl-japan.co.jp

Stay connected with *RIEGL* and follow us on our social media channels

www.riegl.com