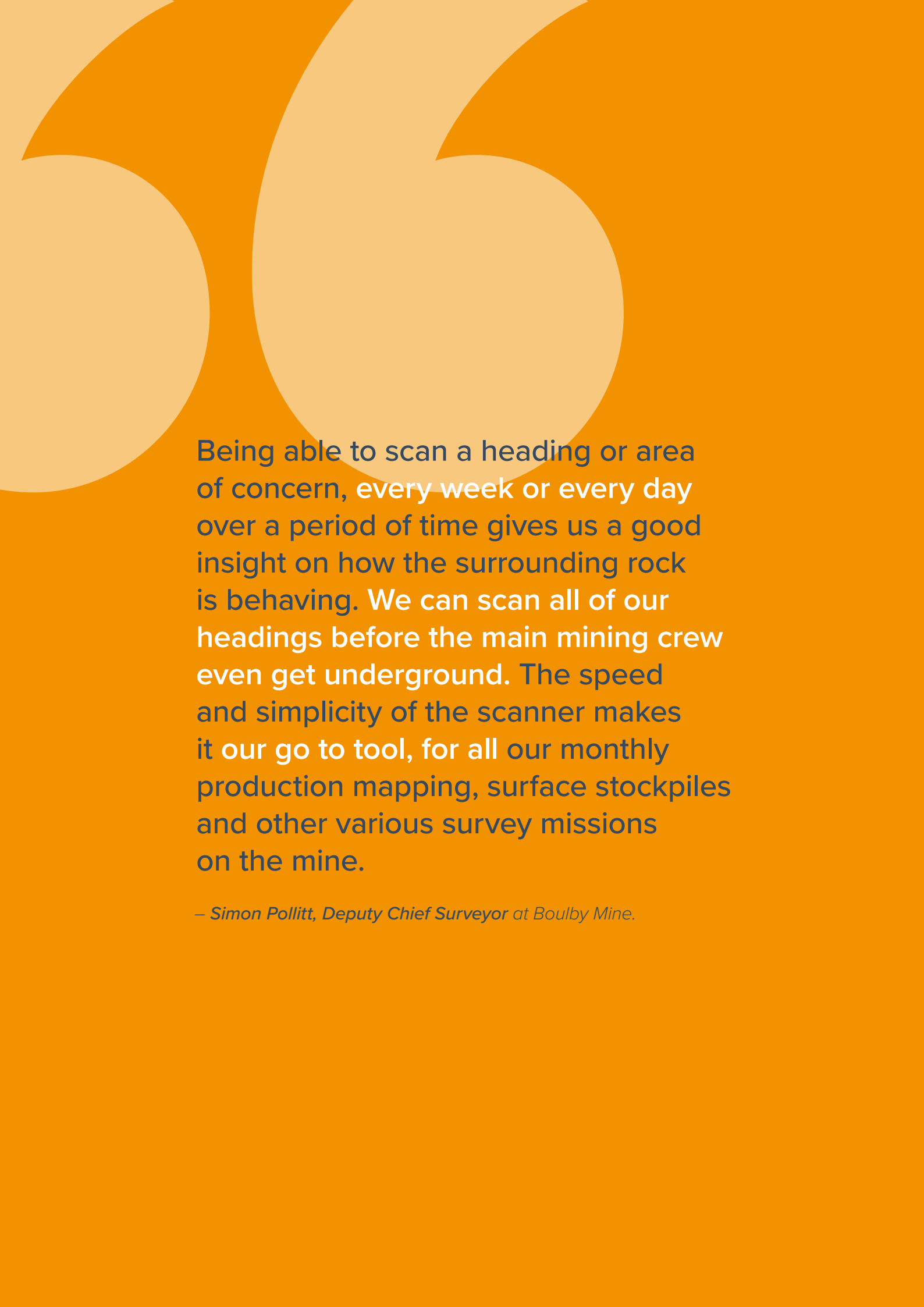# GeoSLAM Mining

Rapid site information for
the **modern mine.**

GeoSLAM

Being able to scan a heading or area of concern, every week or every day over a period of time gives us a good insight on how the surrounding rock is behaving. We can scan all of our headings before the main mining crew even get underground. The speed and simplicity of the scanner makes it our go to tool, for all our monthly production mapping, surface stockpiles and other various survey missions on the mine.

— Simon Pollitt, Deputy Chief Surveyor at Boulby Mine.

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Meet GeoSLAM

GeoSLAM are the global market leader in "go-anywhere" 3D mobile mapping technology. Highly versatile and adaptable to all environments - especially spaces that are indoor, underground or difficult to access, our technology provides accurate 3D mapping without the need for GPS.

We are proud to have built an international dealer network of almost 90 channel partners, in over 50 countries, across all six continents. GeoSLAM work with some of the largest mining companies across the world.

GeoSLAM's SLAM is unique, the most commercially successful on the market and is constantly learning and improving since first launched in the form of the ZEB1 in 2013.

GeoSLAM's SLAM was developed with CSIRO, the Commonwealth Scientific and Industrial Research Organisation, and has since been further optimised to make it smarter and more advanced than ever.

What is SLAM?

Simultaneous Localisation And Mapping – it's essentially complex algorithms that map an environment.

Using SLAM software, a device can simultaneously localise (locate itself in the map) and map (create a virtual map of the location).

SLAM based systems are inherently mobile – they are at their best when used on the move. Gone are the days of multiple static set-ups of bulky tripod-based systems. With a SLAM mobile mapping system, it's possible to simply walk through an environment building a digital map as you go, saving time and money by removing laborious set-ups from the equation.

SLAM based mobile mapping systems slash survey times and can be over 10 times faster at acquiring and processing data.
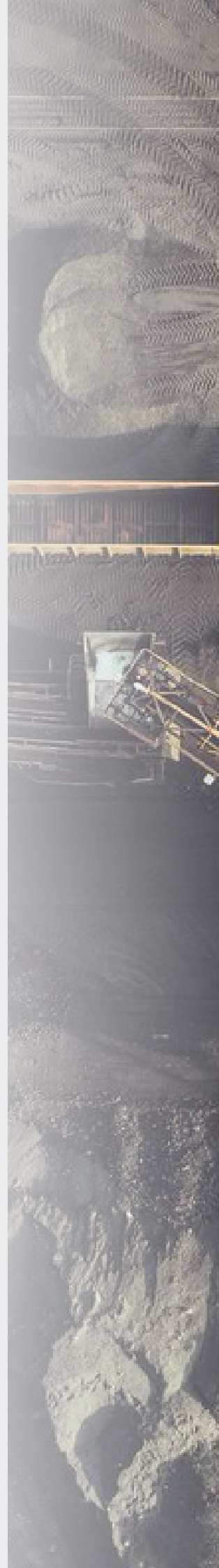
In terms of speed and accuracy, this was a real game changer for us!

– Tina Greenfield at Iowa DOT.

Introduction to mining and georeferencing

Mining survey is one of the most difficult and demanding forms of survey, often in tight and enclosed spaces with immense time and resource pressures. **GeoSLAM Mining** is designed to help optimise your operations, maintaining productivity whilst reducing zero harm targets.

De Beers Group

Glencore

Eldorado Gold

New Gold

Newmont

Rio Tinto

Fine Minerals International

Fortuna Silver

Fresnillo

Desarrollo Minero de Nicaragua S.A

Carbomas S.A.S

Gran Colombia Gold

MINERAÇÃO RIO DO NORTE

Compania Minera Condestable S.A.

Vale

Guanaco Compania Minera

Codelco

Secretaria Regional Ministerial de Minería

MINERA CERRO VANGUARDIA

Why GeoSLAM Mining?

Simple to use - Virtual training is completed in one hour, with no prior experience or training necessary.

Handheld SLAM - One button operation, no set up. Just turn it on, walk and capture.

Rugged hardware can be used in zero light and zero GNSS areas.

You control the data - No need to process off-site. Your data is secure and can be managed according to your procedures.

Georeferencing - With Adjust to Control, registering your data in your coordinate system has never been easier, with no need for GPS.

Export to 3rd party software - Industry standard formats such as LAS, LAZ, E57, TXT and more, integrate seamlessly into downstream applications.

Here are some of our mining customers across the world

Agnico Eagle Finland

Boliden Mineral AB

British Gypsum

ICL

K+S

KGHM Polska Meidz

Balkan Minerals

Matsa Mining

Energia Minerals Italia SRL

Azerbaijan International Mining Company

Georgian Manganese

Kazzinc

Norlisk Nickel

Phosagro

Zijin Mining

Hainan Mining

Kinross

Nordgold

Asanko Gold

Kamoa Copper SA

Barrick

Freeport McMoran

Golden State Mining

Vedanta

Vale

Barberton Mines

Pan African Resources

Lonmin

Petra Diamonds

BHP

Oz Minerals

Glencore

Jacobs

Gold Fields

South 32

Anglo American

Newcrest Mining

Northern Star Resources Limited

Stockpile Volumes Analysis

From one stockpile to many, **GeoSLAM Volumes** easily and quickly calculates bulk material volume and tonnage.

GeoSLAM's powerful mobile technology enables you to build high-density 3D volumetric models within minutes. Our market-leading, handheld laser scanners can determine accurate stockpile volumes, silo reserves or mining tempos, without the need for GPS. Walk and scan, or attach the scanner to a trolley, drone, pole or vehicle for remote monitoring of hazardous environments.

GeoSLAM Volumes software turns data into actionable 3D information for rapid real-time decision making. So now you can confidently verify volumes at all stages of the supply chain as frequently as necessary. Train your staff in minutes, slash survey times and drive down costs.

Key features:

- ✅ **Georeferenced point clouds -** GeoSLAM Connect can automatically process and geographically define the location of your scan.

- ✅ **Floors -** No need for 3rd party CAD software to create planes.

- ✅ **Exclusion boundaries -** Easy to set and will exclude all data in the volume calculation outside the boundary.

- ✅ **Stockpile boundaries and material properties** - Calculation of tonnes by using Specific Gravity and Bulk Factor of the material.

- ✅ **Alarms -** Inventory control through notifying when minimum/maximum volume or height is reached.

- ✅ **Advanced filters -** The ability to remove infrastructure such as roofs, people, equipment and other elements.

- ✅ **Report creation -** Can be compiled as a bespoke PDF report or exported as CSV file to other systems such as SCADA systems.

Stockpile: 1000 Tonnes

Capture

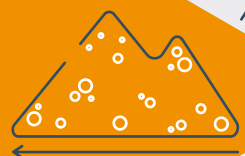Easily walk around the perimeter or fly a UAV over a stockpile.

Process

Automatically process the data using **GeoSLAM Connect**, and load the data into **GeoSLAM's Volumes** Software.

View

Define the boundaries, floor, enter the bulk factor and specific gravity to view volumes.

Manage

Generate volume reports as and when you need them.

Powered by GeoSLAM Connect

- ✔ Automatic SLAM processing of captured data.

- ✔ Assign coordinates file for automatic georeferencing of data.

- ✔ Data is automatically filtered and cleaned.

- ✔ Processed and aligned data is saved automatically to a specified folder.

- ✔ Complete scan can be viewed in the GeoSLAM Connect viewer.

GeoSLAM **CONNECT**

Mine wall structure: Safe

GEOSLAM
CONVERGENCE ANALYSIS

Convergence Analysis

Combining hardware and advanced SLAM, using **GeoSLAM** for **Convergence Analysis** provides mine operators a quick and safe solution to analyse the change of rock movement, highlighting potential slope/rockface instability.

Rapid, regular and cost effective ways of capturing challenging underground environments. The data produced can be used in 3D visualisation and analysis of rock movement.

Key benefits:

✓ An operator can **capture data** in dangerous areas **much faster** than previously possible, making it easier to repeat scans.

✓ **Greater amounts of information** are available and due to the ease of capture, cost effectiveness and frequent scanning, decisions can be made faster, saving time, money and increasing safety.

✓ **Georeferencing** using Adjust to Control, registering your data in your coordinate system has never been easier, with no need for GPS.

✓ **Export to 3rd party software** in industry standard formats such as LAS, LAZ, E57, TXT and more, integrate seamlessly into downstream applications.

✓ **Handheld**, pole or car mounted, there are solutions for accessing all kinds of areas, faster and safer.

Capture
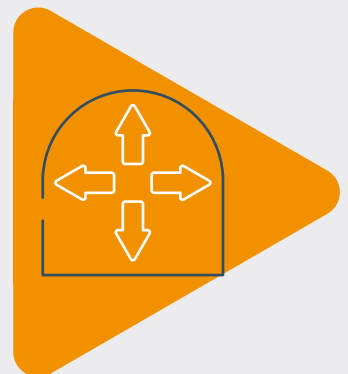Safely and easily scan mine tunnels, with or without control points.

Process
Transfer the data to a computer - **GeoSLAM Connect** carries out automatic data processing.

View
View your processed 3D data in minutes. Export your data in your preferred format.

Manage
Your 3D dataset can be used to analyse time based tunnel displacements in a wide range of mining software.

GEOSLAM
VERTICAL SHAFT INSPECTION

Vertical Shaft Inspection

Using **GeoSLAM's Vertical Shaft Inspection** is a solution for collecting data in hard to reach and dangerous vertical shafts, for inspection or analysis of change. It has a wide range of uses, including understanding of erosion of the shaft wall, view blockages in the shaft, and identify hanging points for ore.

Rapid, safe in-motion data collection in hard to reach areas and dangerous vertical shafts for inspection, 3D visualisation or further change analysis.

Key benefits:

✓ Ability to get **data for quick decision making**, saving time and money, whilst keeping personnel safe.

✓ **Data capture and modelling** is up to **10x faster**, allowing you to make informed decisions which save you costs in the long run.

✓ Specialist design, with a **purpose-built cradle** specifically for lowering into vertical shaft.

✓ **Adjust to control** allows for the data to be georeferenced as part of the SLAM processing. This means all data exports will be in the right coordinates, and can be imported directly to the mine plan or for comparative analysis.

✓ **Exported data** can be used in existing mining software such as Deswik and Micromine, meaning it can be analysed using software that is already familiar to the team.

Capture

Using a purpose designed cradle (sold separately), lower your ZEB to create a digital map of the full depth of a shaft or ore pass.
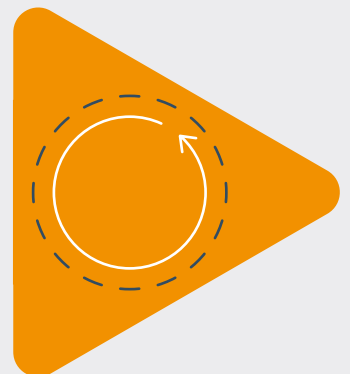
Process

Transfer the data to a computer - GeoSLAM Connect carries out automatic data processing.

View

View your processed 3D data in minutes. Export your data in your preferred format.
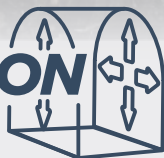
Manage

Use the exported data in any 3rd party system by using cross sections, creating mesh or solids and comparing to a design.

Production
Progress
50% Complete
On Track

GEOSLAM
PRODUCTION MAPPING

Production Progress Mapping

Make short term operational decisions on newly mined production areas, safely and quickly, with **GeoSLAM Production Progress Mapping**.

GeoSLAM is 10 times faster and 3 times more cost effective than traditional scanning solutions.

Utilising **GeoSLAM's ZEB scanners**, capturing data in mines is quick, safe and highly repeatable.

Key benefits:

✓ **Rapid data** capture means fewer hold ups in production, saving time and money.

✓ **Frequency of capture** means companies can keep on track with targets and make necessary logistical changes.

✓ **Automatic processing** and georeferencing of data.

✓ **Exported data** can be used in existing mining software such as Deswik and Micromine, meaning it can be analysed using software that is already familiar to the team.

Capture

Safely and quickly move into newly mined production areas where new information is needed.
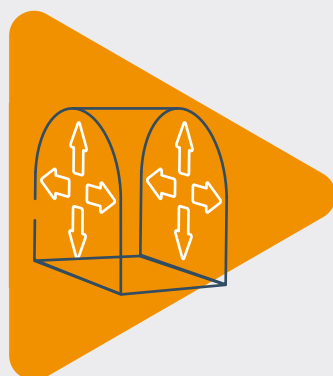
Process

Transfer the data to a computer - **GeoSLAM Connect** carries out automatic data processing.

View

View your data to understand the environment and ensure that all areas were captured effectively.

Manage

Use the exported data in any 3rd party software for further analysis by using cross sections, creating mesh or solids and comparing to a design.

Shotcrete Thickness Analysis

GeoSLAM have designed and built an intelligent solution to help you to make sure your sprayed concrete is applied at the correct thickness using LiDAR scanning.

The **GeoSLAM shotcrete product** is sold exclusively by **Normet** under the SmartScan name.

Why use SmartScan?

- **Identify problem areas straight away** to get the job right the first time.

- **Save wasted concrete** and additives from excessive application thickness.

- **Gain useful management information** particularly to understand wastage and calculate the total over or under spray according to your own parameters.

- **Reduced downtime** means no waiting for survey results.

- **Ensure** your **spray thickness** contractual and legal obligations are met.

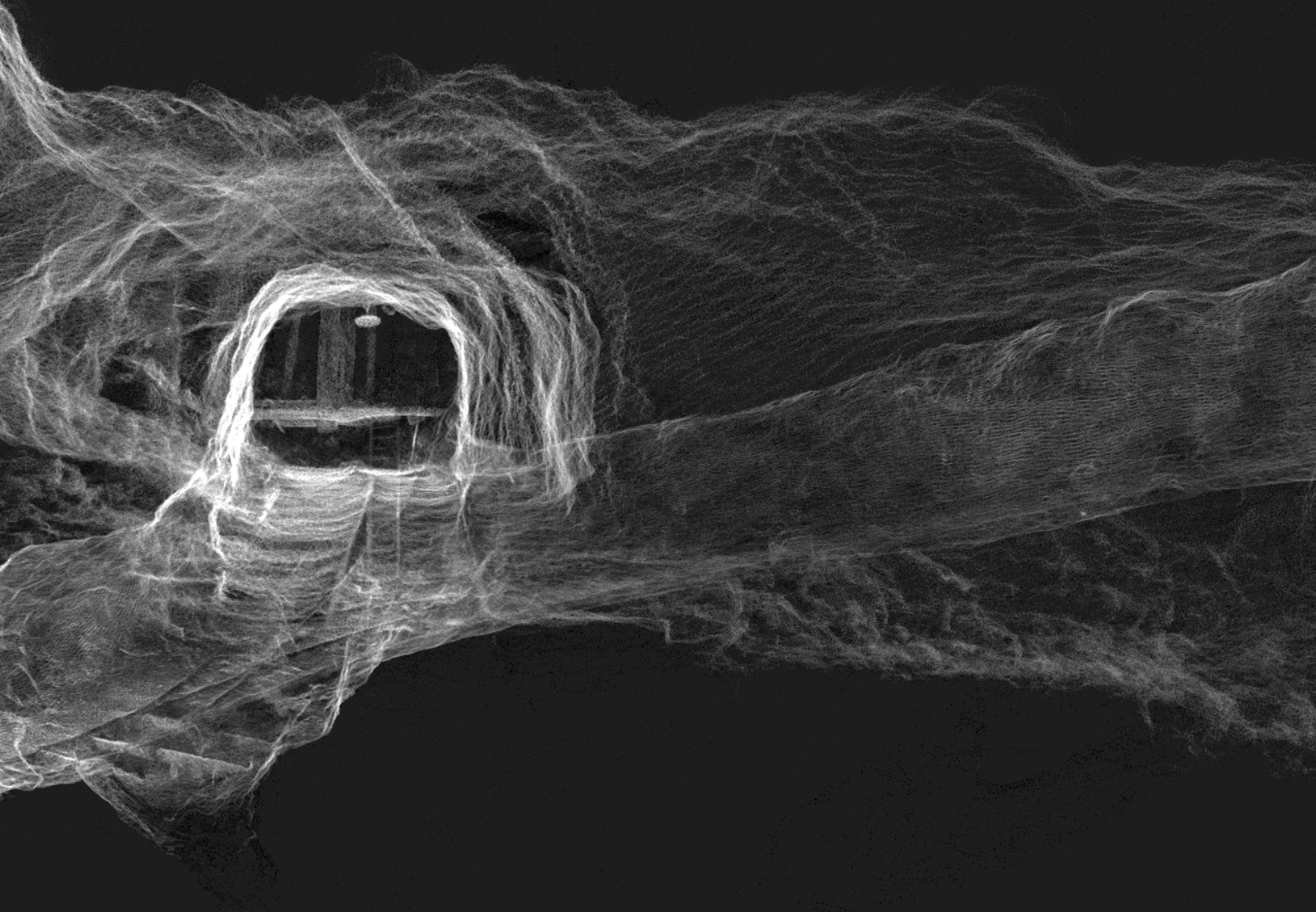- **Built for** and tested in the **harshest environments**.

Applications:

- Sprayed concrete measurements.

- Underground construction.

- Bridge and structural repairs.

- Tunnel lining maintenance.

"

It's critical data that will help us lower the risk to personnel and keep mines safer.

— David Counter at Glencore - Kidd mine.

Meet the
ZEB Scanners

ZEB
HORIZON

About:

Your tool to capture, view and understand the world around you. Great for indoor and outdoor use, including spaces where features are positioned further apart. Lightweight and rugged, simple to use, fast to capture and easy to process giving you the most accurate information you need to make the most important decisions.

Technical specification

Range	100m
Laser	Class 1 / λ 903nm
FOV	360° x 270 °
Frequency	100Hz
Protection class	IP 54
Processing	Post
Data logger carrier	Backpack or shoulder strap
Scanner weight	1.45kg
Datalogger weight (incl. battery)	1.25kg
Colourised point cloud	✓ *
Intensity	✓
Referenced imagery	✓ *
Scanner points per second	300,000
No. of sensors	16
Vertical angular resolution	2°
Horizontal angular resolution	0.38°
Relative accuracy	Up to 6mm**
Raw data file size	100-200MB /minute

Software included: Connect

*With ZEB Cam

**When processing data in GeoSLAM Connect V2

ZEB
GO

About:

The **ZEB Go** is your first step in SLAM handheld technology, so whether it's the first time you've looked at digital surveying, or you want each of your sites equip with the smartest SLAM, the **ZEB Go** is the place to start.

Technical specification

Range	30m (features <15m)
Laser	Class 1 / λ 905nm
FOV	360 ° x 270 °
Frequency	40Hz
Protection class	IP 64
Processing	Post processing
Data logger carrier	Backpack
Scanner weight	950g
Scanner handle thread	1/4-20 UNC
Datalogger weight (inc. battery)	1.7kg
Colourised point cloud	✓ *
Intensity	✗
Referenced imagery	✓ *
Scanner points per second	43,000
No. of sensors	1
Relative accuracy	1 - 3cm**
Raw data file size	100 MB /minute

Software included: Connect

*With ZEB Cam

**Environment dependant

ZEB
REVO RT

About:

Scan, process and track your progress as you go. The **ZEB Revo RT** is handheld, lightweight and easy to use, allowing you to rapidly build highly accurate 3D point clouds within minutes, while on the move. Gain real-time insight into your scan, see the areas you've covered (or missed) and the route you've taken before you leave site. Simple, comprehensive SLAM for everyone.

Technical specification

Range	30m (features <15m)
Laser	Class 1 / λ 905nm
FOV	360 ° x 270 °
Frequency	100Hz
Protection class	IP 51
Processing	Real time
Data logger carrier	Shoulder strap
Scanner weight	1.05kg
Scanner handle thread	1/4-20 UNC
Datalogger weight (incl. battery)	1.95kg
Colourised point cloud	✓ *
Intensity	✗
Referenced imagery	✓ *
Scanner points per second	43,000
No. of sensors	1
Relative accuracy	1 - 3cm**
Raw data file size	100 MB /minute

Software included: Connect

*With ZEB Cam

**Environment dependant

Setting you up for success

GeoSLAM Care makes sure you get the most from your ZEB products.

Combining the very best in after sales, **GeoSLAM Care** is a simple and comprehensive support package to make sure you have all the resources you need, you'll also have access to our team of support engineers should you need any help.

GeoSLAM Care includes:

Hardware Support
Up to 3 years hardware warranty to ensure your ZEB is always performing at its best.

Remote Support
Unlimited software support from our expert engineers.

Software Updates
Access to new software releases and all the latest features.

GeoSLAM Academy
Our user platform including user guides, how to videos, software release notes and more.

GEOSLAM
CONNECT

Next generation SLAM software

GeoSLAM Connect is a flexible software platform that can be configured to perform end-to-end analysis of ZEB scan data. **GeoSLAM Connect** uses GeoSLAM's world-leading SLAM algorithm at its heart and also includes visualisation, additional processing, filtering, workflow automation functionality, as well as integration to 3rd party applications.

With the press of one button, your data will be automatically processed, saved in a folder of your choice, and prepared for the next step of your workflow.

Key Features:

- ☑ Stop & Go Georeferencing.

- ☑ Stop & Go Merging.

- ☑ Point Cloud Cleaning - Including Range Filtering, Decimation and Outlier Removal.

- ☑ 3D Viewer.

- ☑ Workflow scripts.

- ☑ Corresponding Smartphone App.

ZEB ACCESSORIES

ZEB Horizon accessories

The **ZEB Horizon** is a multi-use device, meaning that not only is it useful for a range of applications in it's handheld state, but it can be used with a wide range of accessories which greatly expands it's usability. No matter what your data collection needs are, the re-usability of the **ZEB Horizon** makes it an essential tool for mining.
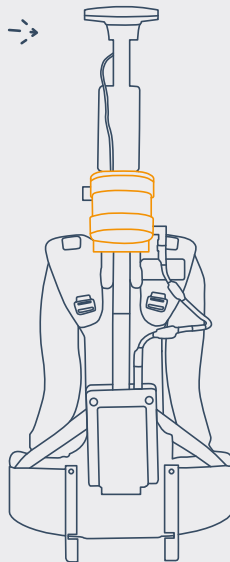
ZEB LOCATE

Use cases:

- Waste area mapping
- Road mapping
- Pantograph line inspection
- Large stockpile mapping
- Tailings dam mapping

Usage:

Attach to backpack and GPS, and walk outdoor areas to get georeferenced data.

ZEB POLE

Use cases:

- Ceiling cavity mapping
- Stockpile mapping
- Tall structure mapping
- Silo mapping
- Manhole mapping

Usage:

Attach to the pole to reach into ceiling cavities, top of stockpiles or just more height.
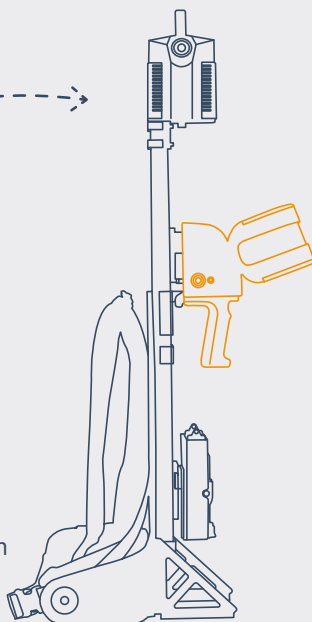
ZEB DISCOVERY

Use cases:

- Open pit mapping
- Plant mapping
- Face mapping
- Geology mapping
- Exploration sites

Usage:

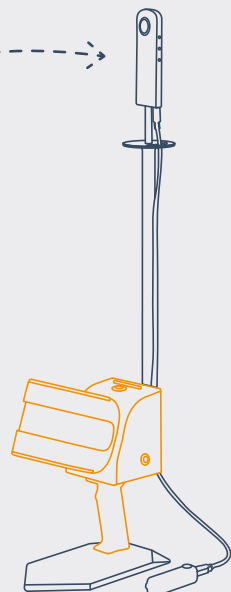Attach to backpack and high resolution camera and walk outdoor areas to get colourised data.

ZEB PANO

Use cases:

- Geological mapping
- Roof bolt mapping
- Shotcrete inspection
- Blast face inspection
- Ventilation positioning

Usage:

Attach to panoramic camera and take pictures at desired locations to reference in scan.
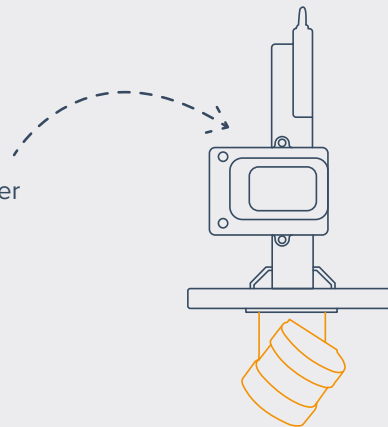
ZEB
HORIZON

ZEB
CRADLE

Use cases:

- ✓ Vertical Shaft inspection
- ✓ Ore Pass inspection
- ✓ Air shaft inspection
- ✓ Raise bore inspection
- ✓ Silo Volume

Usage:

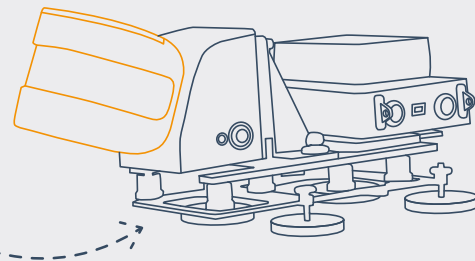Attach to rope/cable and lower down shafts, silos, manholes, caves, etc.

ZEB
CAR MOUNT

Use cases:

- ✓ Mine mapping
- ✓ Mine road mapping
- ✓ Large stockpile mapping

Usage:

Attach to vehicle to cover large mining areas.

ZEB
UAV MOUNT

Use cases:

- ✓ Tailings dam mapping
- ✓ Large area mapping
- ✓ Large stockyard mapping
- ✓ Open pit mapping
- ✓ Mine road mapping

Usage:

Attach to UAV to cover larger areas.

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