

Cavity Auto-scanning Laser System

The Carlson C-ALS laser system provides safe, quick, and reliable mapping capabilities for inaccessible underground cavities. Deployable via boreholes on cable or rods, via a boom, or on a zip-wire, the C-ALS system can be used from the surface to provide a detailed visual record of the subsurface environment in a wide range of applications. A C-ALS Gyro option now gives greater navigational capability, ensuring that the probe's position along the borehole can be determined without relying on the mechanical alignment of deployment rods or a magnetic compass.

C-ALS supports successful projects

The Carlson C-ALS system enables laser scanning of air-filled voids to create geo-referenced 3D models of subsurface conditions as a cost-effective, comprehensive, and accurate alternative to systematic drilling, enabling users to:

- Protect worker safety
- Report to project stakeholders in greater detail
- Cost out planned works accurately
- Devise more efficient work programs
- Move new projects forward faster
- Design and engineer solutions based on accurate data
- Minimize disruption, drilling, and disturbance in populated areas

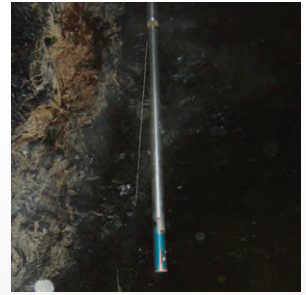
The advantages of C-ALS laser scanning

- Ability to survey potentially dangerous underground voids safely
- Get precise and accurate cavity/void measurement in minutes, not days
- 360° spherical coverage for a full view from a single scan, with no blind spots
- Operation is remotely controlled
- Deployment methods are flexible
- Easily transported
- Rugged design for durability in extreme conditions -
 - IP67 rating (probe only)
 - Withstands submersion to a depth of 1 m (in case accidentally deployed in a flooded cavity)
 - Withstands extremes of temperature and high humidity



How it works

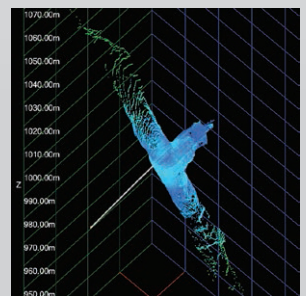
- With a diameter of just 50 mm, the **Carlson C-ALS** system is easily deployed through boreholes, downhole or uphole in order to survey inaccessible spaces.
- A system of hinged, lightweight, 1 m rods provide a fixed azimuth capability, as well as the ability to deploy the **C-ALS** down boreholes as long as 200 m.
- The **C-ALS** probe incorporates pitch-and-roll sensors. The sensors ensure **C-ALS** can be tracked both up and down the borehole and that the scan is automatically georeferenced to fit into existing 3D mine data.
- Alternatively, the **C-ALS Gyro** uses an internal MEMS IMU to establish the heading and inclination of the probe as it is deployed. An initial reference azimuth is determined on the surface and the survey is then relative to this heading. This gives the possibility of more flexible, cable-only deployments.
- A nosecone camera, embedded within the end of the **C-ALS** probe, provides onscreen video and a real-time view of the borehole as the probe is deployed. This allows operators to see any obstructions, and judge the point at which the **C-ALS** scanning head and rotating horizontal shaft breaks through into the void.
- Once in the void, a simple click from the operator commands the laser-scanning head to rotate on two axes, measuring the 3D shape of the void with full (horizontal axis) 360° coverage and no blind spots, and with a range up to 150 m.
- Operators control **C-ALS** from a distance, via the robust PC or tablet that may be optionally included in the package. PC or tablet is linked to the **C-ALS** system by Ethernet cable or a WiFi link. From a safe distance, the operator can view live data, analyse point clouds and create models.



The C-ALS system deployed downhole to survey an inaccessible underground void.



The nosecone camera provides a helpful view into the borehole during deployment.

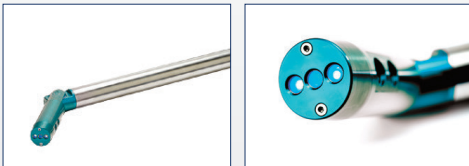


The probe rotates on two axes to create full 360-degree scans of voids and cavities.



Monitor excavations, assess risk, or design solutions

Utilize the **Carlson C-ALS** system when a complete picture of the situation underground is needed. Identify, measure, and map voids below construction or geo-technical projects to help avoid/prepare for differential settlement, sinkholes, or even catastrophic collapse of old mine workings or voids that may underlie residential and commercial properties. With the complete picture the **C-ALS** system provides, engineering solutions can then be put into place to counter the problems. The C-ALS system can be used in a huge range of applications where an inaccessible void exists and accurate data is required.



C-ALS Gyro option

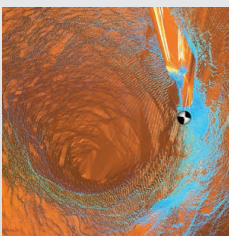
C-ALS units are available with a fitted, miniaturised MEMS IMU. The IMU contains a 3-axis gyro which monitors the probe's heading and accelerometers which determine the inclination. In this case, the lightweight rods are not required for their original purpose of mechanically aligning the probe during a deployment. The rods may still be useful to push the probe along horizontal or uphole deployments, or to retain stability during free-hanging deployments. In other cases, with the gyro active, the **C-ALS** can be lowered just with its cable, or with the addition of a manual or powered winch.



The ruggedised PC enables you to carry out operations on site in extreme environments.

Prior to a deployment, the **C-ALS Gyro** probe is set out in a stable position and its heading is established in relation to the mine's grid system. This forms the reference orientation for the rest of the deployment.

The software automatically identifies the gyro & offers controls appropriate to this variety of **C-ALS**.



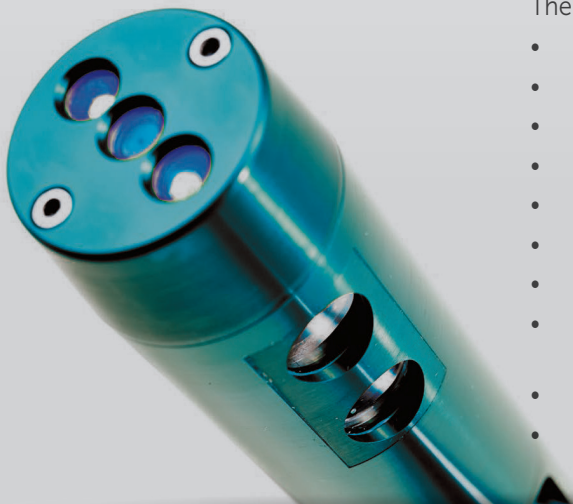
Laser cavity scans are easy to export into a large range of software packages.

Support underground or surface mining projects

By using **C-ALS** to determine the size, extent, and status of inaccessible voids, mining customers get a complete picture of the situation underground before committing to projects or deploying workers. In addition, a full understanding of the layout of underground workings and their relation to surface operations is also essential for safe open-pit operations using heavy machinery, explosives, and personnel.

The **C-ALS** system provides a detailed visual record of the following:

- Excavation and infill of stopes
- Location of voids
- Geometry and condition of mine workings
- Inaccessible historic workings
- Collapsed areas, sinkholes, and troughs
- Erosion of ore passes
- Volumes of voids
- Position of cavities in relation to other underground workings and structures
- Size and location of remaining pillars
- Location of the voids/workings relative to surface features



C-ALS® Software

Carlson's software for C-ALS makes it easier and quicker for operators to use the system, to analyse collected data and to produce industry-standard deliverables.

- Quick navigation and intuitive design for both new and experienced operators.
- Smooth and efficient animation and point cloud rendering
- Optimised for ruggedised, touchscreen tablets for easy in-field use
- Desktop mode for reviewing data in the office.
- See the heading, inclination and activity of the animated C-ALS probe at all times
- Real-time surfacing and volume calculation from raw scan data for the production of closed 3D models and volumes
- Quickstart mode with single-click project setup up and instrument auto-detection
- Save live footage from the C-ALS camera
- Integration with third-party packages with the ability to import and export formats, such as LAS and DXF

ABOUT CARLSON

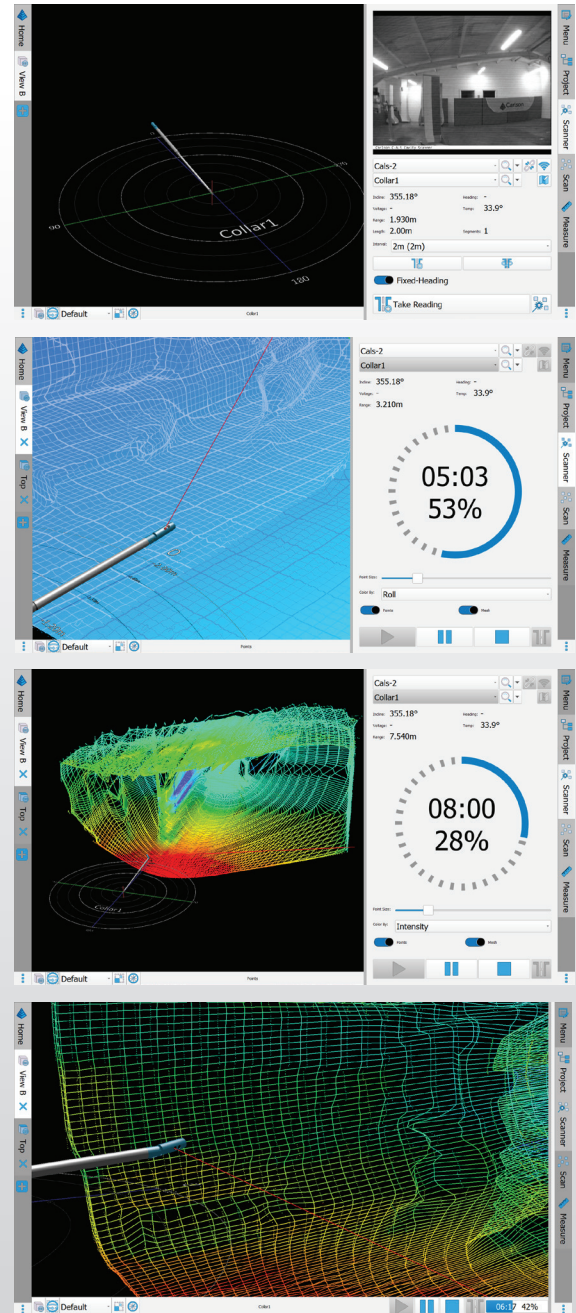
Carlson Software is a global market leader in the production of comprehensive software for Mining, Civil Engineering, Land Surveying, Machine Control, GIS, and Accident Reconstruction as well as instruments with GNSS, optical, and laser technology. Its Laser Measurement Devices (LMD) division has three decades of industry experience designing and manufacturing laser products.

Founded in 1983, Carlson Software is headquartered in Maysville, Kentucky, U.S.A. Its worldwide network of subsidiary companies and distributors provides exceptional service and support for its customers.

Carlson LMD products include:

- Cavity Auto-scanning Laser System (C-ALS®)
- Cabled Boretrak®
- Rodded Boretrak®
- Quarryman® Pro
- Merlin
- Industrial Laser Module (ILM)
- Void Scanner

For further information on the best Carlson application to meet your needs or for support, please contact Carlson at lasermeasurement@carlsonsw.com.



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