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. These include underground and open-cast mining, construction, subsidence investigations, and subterranean excavations.

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. C-ALS can also be deployed by boom, zip-wire or by remote-controlled vehicle.
- 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 so operators can see any obstructions, and judge the point at which the C-ALS scanning head pivot and rotating horizontal shaft breaks through into the void.
- 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.
- 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-degree coverage and no blind spots, and with a range up to 150 m².
- 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, they can view live data, analyse point clouds and create models.
- The use of the remote PC or tablet keeps operators safe while offering broad visibility of the probe’s location and what is happening underground.
C-ALS Applications

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, including:

• Subsurface voids and cavities
• Underground chambers and tanks
• Ducts
• Inaccessible roof spaces
• Stopes
• Ore passes
• Collapsed mine workings
• Culverts
• Shafts and bunkers
• Underground caverns
• Industrial production facilities with limited or unsafe access

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

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

Laser cavity scans are easy to export into a large range of software packages.
C-ALS® Software

Carlson’s software for C-ALS makes it easier and quicker for operators to learn and use the system by guiding them through the process of deploying and scanning to enable:

- Quick navigation and intuitive design for both new and experienced operators, both reducing training needs and improving efficiency
- “Seeing” the heading and inclination of the C-ALS probe at all times
- One-click surfacing and volume calculation from raw scan data for the production of closed 3D model and volume within seconds of finishing a scan
- Point cloud editing and visualization on site
- Swifter setup time due to auto-connection to the C-ALS probe
- Saving and sharing of video footage with live recording from the C-ALS camera into WMV
- Easy integration with third-party processing software packages with ability to export to many industry-standard formats, including 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.