

# LKAB KIRUNA SEISMIC EVENT INSPECTIONS



## Emesent Hovermap technology helps LKAB complete fall of ground inspections quickly and safely at Kiruna mine.

Swedish mining company LKAB mines and processes iron ore for the global steel market. Its mine in the northern city of Kiruna commenced production in 1898. Today, it's the world's largest underground iron ore mine, producing around 27 million tonnes of iron ore a year.

### THE CHALLENGE: SAFELY SURVEYING THE DAMAGE AFTER A SEISMIC EVENT

On 17 May, 2020, the LKAB Kiruna Mine experienced a seismic event that resulted in significant fall of ground, deep within the site. The mine was immediately closed and mine managers began determining how best to assess the damage.

Historically, mining companies were forced to carry out this exercise manually, making notes and sketches and taking photographs where possible. As well as being dangerous, manual inspections are labor intensive, time consuming and inaccurate.

LKAB management sought a means of carrying out a comprehensive, accurate survey of the damage, without risking the safety of LKAB employees or contractors.



“We were able to scan much faster than LKAB expected. Nearly all the areas LKAB had identified for inspection were scanned on the first day. We were quick, way quicker than they expected.”

Alexander Paulusson, CEO | AMKVO AB

AMKVO conducted over 30 flight and walking scans, at a depth of 1,236 meters below the surface, to map the damage throughout kilometers of drifts in Kiruna.

### THE SOLUTION: SEND IN HOVERMAP

Emesent partner, AMKVO, a Swedish remote sensing specialist, was contracted to conduct damage inspections at Kiruna Mine, commencing 31 May, 2020.

AMKVO spent four days underground mapping the damage in the mine, using Hovermap mounted to a DJI M210 drone or handheld, at a depth of 1,236 meters below the surface.

AMKVO completed 30 scans in challenging conditions, navigating the drone around collapsed services, ventilation bags, and rock falls. To fly through narrow openings, AMKVO adjusted Hovermap's virtual shield (collision avoidance) settings. Dust had little impact on Hovermap's simultaneous localization and mapping (SLAM) collision avoidance and point cloud capture quality.

“The dust didn't affect the flying or the scans. In dusty areas, the scans had noise around the drone, but that was easy to filter out. Even in the absolute worst conditions, where we couldn't see the drone, we still got a perfect tunnel scan. I was impressed by how well Hovermap worked.”

Alexander Paulusson, CEO | AMKVO AB

Data was sent to the surface as it was collected for analysis by LKAB's mine planning and safety teams.

### DELIVERABLES

Before leaving site, AMKVO delivered georeferenced point cloud data sets of tens of kilometers of mapped drifts, still images and animated films.

### KEY ACHIEVEMENTS



Reduced safety risk for LKAB personnel and contractors



Comprehensive damage assessment within weeks



Faster remediation and return to production



Timely communication of information to stakeholders

## USING ACCURATE DATA TO PLAN THE PATH FORWARD

Using Hovermap to scan the Kiruna Mine enabled LKAB to obtain an accurate picture of the damage within weeks of the seismic event occurring, without risk to human safety.

The data was used to inform remediation planning, including the extent of rock reinforcement required and the repairs necessary to damaged plant and equipment within the mine.



The seismic event triggered rock bursts across kilometers of drifts. Armed with accurate 3D datasets, LKAB engineers were able to start planning remediation work within weeks of the event.

A significant seismic event typically generates considerable media and community interest. Having a comprehensive understanding of the damage allowed LKAB to provide stakeholders with timely status updates and their proposed remediation schedule. The videos created by AMKVO allowed LKAB workers and those living in the Kiruna area to view the damage firsthand and develop an appreciation of the work necessary for operations at the mine to recommence.

LKAB subsequently purchased three Hovermap scanners for ongoing use in mine sites across Sweden.

“Safety must always come first. This is a safe and efficient way to work. No one carrying out inspection work will be exposed to any kind of risk.

Material from the drone flights is already being analyzed, which means that damage surveys can be done more efficiently, more safely and faster than before.

In terms of safety and technology, the use of drones and scanners represents a major step forward.”

**Per Brannman, LKAB section manager**



AMKVO delivered georeferenced point cloud data sets, still images and animated point cloud films. LKAB published the films to inform stakeholders, employees and local residents of the extent of the damage.