Paul Moore spoke to Dr Christian Riedel, Head of Mining Automation at indurad on how radar is increasing its influence in autonomous fleet sensing

Q How has radar use in mining changed from initial deployment in autonomous machines?

A Legacy automation systems for mining applications rely, among other perception sensors, on automotive-spec radars for medium and long distance CAS in a limited field of view per sensor. The sensors are merely protected in a more ruggedised housing. However, the sensors themselves and signal processing are conventional. Today, the automation system's perception is based on indurad's unique 360º radar technology scanning with up to 50 revolutions per second. indurad's radar technology is designed for the harsh mining environment and does not compromise on point cloud imaging unlike low-cost automotive radar sensors that rely on inaccurate digital beam forming, patch antennas and integrated MMIC chipsets. It scans the machine's surroundings with high accuracy (sub-millimetre ranging accuracy) while being largely unaffected by environmental influences such as dust, rain, fog, or snow.

indurad has successfully demonstrated that trackless mobile machine automation in harsh mining environments including terrestrial mapping is feasible with radar-only perception

Radar is the only technology that maintains its high OEE in even the harshest mining environments.

Q Can you give more detail on how radar uniquely handles mining conditions?

A Mining and tunnelling applications are characterised by extreme environmental conditions such as dust, mud, water, rain, fog and snow. Furthermore, machinery and thus its sensor technology must endure a wide temperature range from -40º to +60ºC at different sites. Additionally, mobile machines such as trucks and loaders components must withstand high acceleration in multiple axes. In some applications corrosive water poses another challenge to sensors. Radar is by far the most suitable technology for harsh environments due to its favorable wavelength compared to optical systems such as LiDAR or cameras. indurad's high-precision scanning dynamic radars are specifically designed for high vibrations for a great variety of industrial applications.

Q Can radar handle mining applications on its own?

A indurad has successfully demonstrated that trackless mobile machine automation in harsh mining environments including terrestrial mapping are feasible with radar-only perception. This technology already incorporates advanced signal processing algorithms and AI approaches for more challenging object detection and mapping tasks. Throughout its portfolio indurad has showcased in a great variety of applications for underground and surface mining that radar fulfills all requirements for perceiving the environment. Object classification, object edge precision and lane tracking are typically done with optical system such as cameras. Due to the absence of street signs and street lanes in off-road applications these capabilities are not required. Concluding, a radar-only approach is feasible. However, in certain applications it can be still useful to implement a diverse redundant approach incorporating optical systems and fuse the data accordingly.

Q Is progress a combination of radar sensors in mining becoming more accurate plus how their data is used by the command and control systems?

A There is a clear tendency towards higher angular resolution and scanning rates that enable perceiving the environment in great detail at low latency for all relevant scenarios in industrial and mining applications and thus, enable fast and precise machine control.