

CONNECTIVITY SOLUTIONS FOR INDUSTRIAL INTERNET OF THINGS IN THE MINING INDUSTRY

Industry 4.0 has led companies to investigate the automation of traditional manufacturing and industrial practices using modern smart technologies via Industrial Internet of Things (IIoT) making agricultural and mining equipment, trucks, and other heavy industrial assets smarter via effective connectivity solutions.



Overview

Not without its challenges, this shift requires a comprehensive understanding of IIoT and the technologies it encompasses such as optimized antenna design, WiFi access point efficacy, and full radio coverage systems. The advanced electromagnetic and wireless propagation simulation tools in [Altair Feko](#) help companies overcome these challenges, leading to fully connected and reliable networks for heavy equipment operations.

To demonstrate the considerations needed to develop a heavy equipment IIoT strategy, we will focus on examples in the mining industry. There are two main types of mining techniques: surface mining and sub-surface mining. Surface mining has safety and scope advantages that have led various technologies to be developed specifically for it. However, safety is still a major concern as large machinery can fall at any time due to complicated and unstable terrain. As a result, the mining sector has long been exploring the possibilities of remote and autonomous mining by integrating remote drills, excavators, and driverless haulage trucks.

Challenges of Remote and Autonomous Mining

1. Remote mining sites

Mines are generally located in remote areas where network coverage is weak. This new generation of mining requires a strong network to be constructed, ensuring effective fleet management, traffic control, and production planning.

2. Low-latency networks for intelligent mining

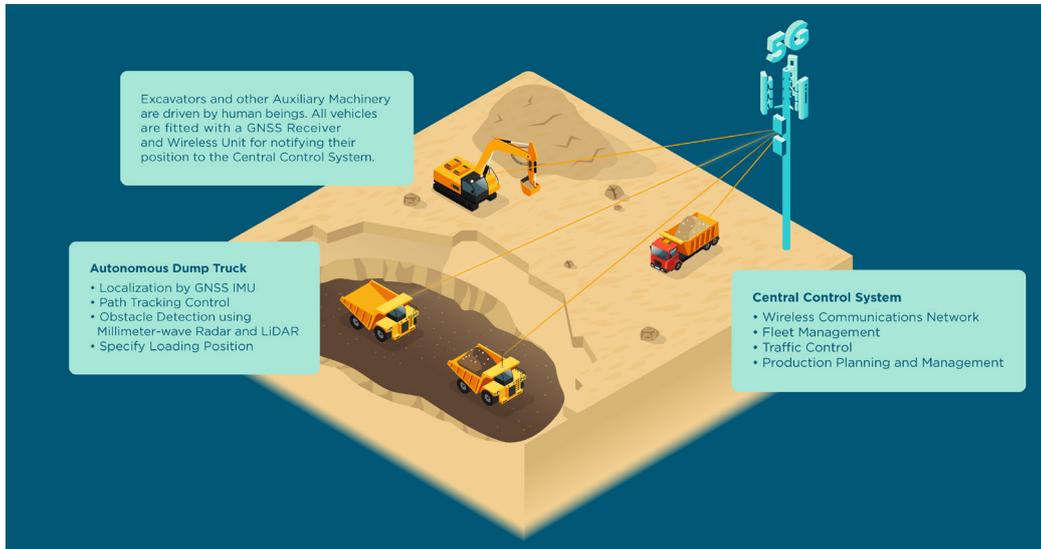
HD video and imagery of remotely operated machinery needs to be transmitted to the central control system or a mobile device with minimal lag to ensure maximum efficiency and productivity.

3. Precise positioning for driverless haulage trucks

When in operation, driverless haulage trucks rely on accurate positioning data to complete complex mining tasks successfully. Inaccurate positioning data results in inefficient operations leading to higher production and running costs overall.

How 5G Enables Safer and More Efficient Mining

Implementing a 5G network can offer a viable solution to these problems. The use of a 5G network for maximum coverage at a large, remote mine enables effective connectivity between a central control system and the various technologies in operation. Thanks to the high bandwidth of these networks, transmission of HD video from remotely operated machinery is also possible, minimizing lag. Lastly, accurate positioning of autonomous haulage trucks can be realized thanks to the superior capabilities of 5G.

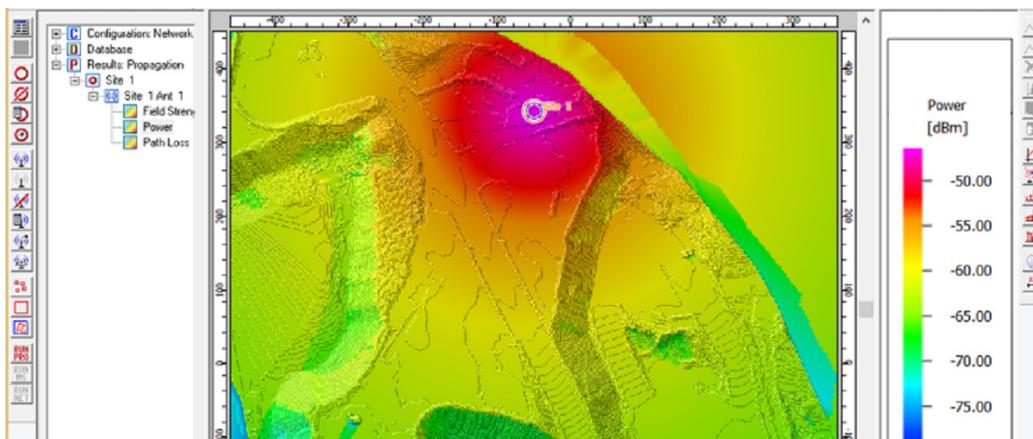


Analyzing the radio coverage of an underground mine

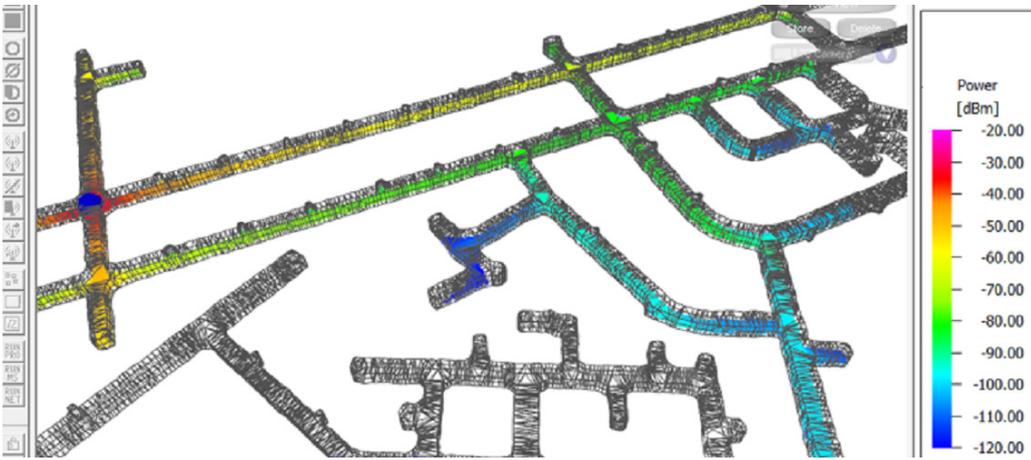
As networks and applications grow, the precise simulation of antennas in their environment is the key to developing the next generation of network products. [Altair 5G](#) simulation solutions support and enable the innovation and deployment of wireless connectivity technology improving communication, assuring compatibility, and reducing energy consumption and emission. The possibility of exact representation from single antennas up to complete systems interacting with their infrastructure and environment allow a unique prediction quality and efficient network realization.

Surface and Sub-surface Mining Connectivity

Whether it is a surface or sub-surface mining plant, understanding the possible connectivity challenges enables engineers to establish the best place to position signal repeaters for optimized radio coverage. Using Feko, map data can be converted to display the topography of an area, as well as tunnels and possible obstacles that could interfere with radio waves. A dominant path model (DPM) can then be used to perform radio coverage analysis.



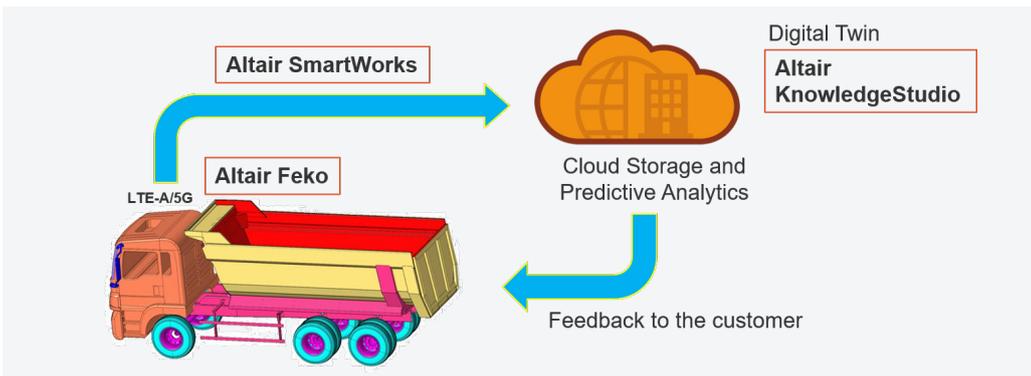
Analyzing the radio coverage of a surface mine



Analyzing the radio coverage of a network of tunnels within a sub-surface mine

Converting Existing Equipment using Altair Connectivity Solutions

Dump trucks within the mining industry are known to have minimal communication ability. However, antenna design, placement, and 5G connectivity can be understood and optimized using Feko, making it possible to communicate with the Cloud via [Altair SmartWorks™](#). From here, a machine learning model can be trained via [Altair KnowledgeStudio®](#) to perform predictive maintenance analytics, allowing companies to mitigate the risk of breakdowns and component failure. Real-time performance of the truck can also be leveraged to allow immediate adjustments if necessary.



Using Altair's connectivity solutions, companies can generate useful insights about performance

Solutions for Heavy Equipment
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Working with Altair

The mining industry faces a lot of challenges and remains under high pressure to control costs, improve operational efficiency as well as meeting stricter environmental regulations. Innovation and the use of technology play a key role in addressing these and in shaping the future of mining. Advanced technologies such as IIoT can help mines increase productivity, reduce costs, and improve safety.

Due to increasing complexity and a higher demand for wireless connectivity for all kinds of products, physical measurements are more and more supported by virtual testing, not only on a component level but also for full platforms to support the heavy equipment industry. Electromagnetic Simulation in the design stage is crucial for a successful deployment of antennas and antenna systems also in their environments.

From antenna simulation and placement, radio coverage, network planning, and spectrum management, to electromagnetic compatibility (EMC/EMI), radome modeling, bio-electromagnetics and RF devices, Feko combines with other Altair tools to optimize system performance through machine learning and reduce modeling time for complex systems.

To learn more about Altair 5G solutions, visit altair.com/5G