VEHICLE INTERACTION CONTROL IMPROVEMENT WORK PACKAGE SUMMARY

WBS Reference:	5. New Vehicle Interaction Control Implementation (Phase 4)
Work Packages:	5.1 Relevant Options 5.1.1 React Technology Options 5.1.2 Site Infrastructure Requirements
Package Owner:	Project Manager
Owner Organisation:	Your company
Participants:	Project manager, project team, experienced operations personnel, site technical personnel, experienced maintenance personnel
Capability required:	Oversight by project manager, project team and senior operations personnel

Description:

Update and confirm site user requirements (functional, performance and technical) for new technology controls (WBS Component 3.3 and 4.2), the update should reference the current Site VI Control Framework.

Identify relevant company vehicle interaction requirements for new technology controls (EMESRT Level 8 and 9) based on operation type: e.g. underground coal mining, underground hard rock mining, open cut mining, refinery etc.

Confirm site infrastructure requirements for each technology option.

Prepare a site functional, performance and technology specification and review it against technology performance summaries of preferred PDS suppliers

Select the best fit from preferred PDS technology suppliers and request that they complete a summary of their product performance against site functional and performance requirements

If other technology options are considered ensure that they meet minimum set requirements based on ACARP PDS validation framework (draft ISO standard)

Summarise capability, installation and maintenance costs, upgrade potential, data management and fit with future mine digitisation plans and other relevant information for each option

Compare site and company requirements, identify any difference e.g. additional site-specific requirements and/or restrictions e.g. requirement for machine swing interlocks and orebody precludes use of magnetic field PDS etc.

Completion State:

A summary of potential new Vehicle Interaction Controls including the integrated use of complementary technologies.

Trackless Mobile Machine Collision Avoidance System at Glencore Waterval Mine

React technology options

The primary means of determining distance between miner and vehicle is done using a technique known as Time-of-Flight (TOF) ranging. This technique relies upon the system being able to measure the time of transmission and time of arrival of a wideband signal in the Super High Frequency (SHF) range. The practical accuracy achievable is better than 0.5m, with a range of up to 30m in typical conditions.

Additional technology for redundancy of operation

Redundancy of operation to the primary TOF functionality, the system employs two other distinct RF technologies for measuring distance, namely Ultra High Frequency (UHF) received signal strength indication (RSSI) and Very Low Frequency (VLF) magnetic field generation. These RF technologies operate using fundamentally different concepts to that of Time-Of-Flight and therefore act as appropriate backup mechanisms for detecting people around the vehicle. This increases the reliability of the system and forms one of the fundamental strategies of ensuring the system is as failsafe as possible.

Estimating distance from UHF RSSI (Received Signal Strength Indication) relies upon the fact that as an RF signal propagates away from its source, it decays in strength the further away from the source it gets. This allows a receiver to roughly determine how far away the source is based on the strength of the signal it receives and comparing this to the known transmitter signal strength. The achievable accuracy is dependent on the conditions of propagation, but typically is in the order of tens of metres. Although the accuracy is poor, the range of the UHF communications is over 100m, giving good indication of vehicles approaching from far off or around corners, behind obstacles. As such, the system uses it as a sanity check on the TOF result and also to give advance warning of proximity situations, since the range is greater than TOF. This will typically be used to display objects in the "awareness zone" of a vehicle.

The other technology providing redundancy for the system at distances below 10m is by using VLF to set up a magnetic field around the vehicle. Since the strength of the field at low frequencies decays very sharply and is also less dependent on the environment than higher frequency RF, this allows the system to get a good idea of the distance between tag and vehicle (pages 11-12)

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References:

- ACARP PDS validation framework (link to be provided)