

# HUMAN-SYSTEMS INTEGRATION FOR THE SAFE IMPLEMENTATION OF AUTOMATION IN MINING

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## **ABSTRACT**

The introduction of automation to mining has great potential to reduce safety and health risks by removing people from hazardous situations. However, automation does not remove people from the system - it just changes the tasks they undertake. For the system to function safely, these new tasks must be designed taking human abilities and limitations into account. This includes maintenance tasks as well as operational tasks. Automation can also introduce new types of errors and, potentially, new hazards. An overriding focus on safety has been identified as a critical aspect of the successful introduction of automation.

The choice of functions to be automated requires consideration of the capabilities and limitations of humans. People are good at perceiving patterns. They adapt, improvise and accommodate quickly to unexpected variability. People are not good at precise repetition of actions, or vigilance tasks. However, system design requires more than allocating functions to person and machine – rather the challenge is to identify how the operator/supervisor and automated components can collaborate to perform the functions required and achieve both safety and health benefits, as well as improved productivity. Interactions between system maintainers and automated components also require detailed consideration.

Human-systems integration refers to a set of systems engineering processes that ensure that human-related issues are adequately considered during system planning, design, development, and evaluation. There are six core domains of human-systems integration that are relevant to the introduction of automation in mining: staffing; personnel; training; human factors engineering; safety & occupational health. Human-systems integration incorporates human-centred analysis, design and evaluation within the broader systems-engineering process. That is, human-systems integration is a continuous process that should begin during the definition of requirements for any automation project, continue throughout system design, and throughout commissioning and operation to verify that safety goals have been achieved.