



## UNDERSTANDING THE IMPORTANCE OF FUNCTIONAL SAFETY FOR AUTONOMOUS EQUIPMENT

Functional safety for autonomous mining equipment is important to all mining stakeholders, and the interest in the ongoing GMG project is a testament to that. Its importance and priority is clear, but what does functional safety mean in this context? What does functional safety for autonomous mining equipment look like right now? What is the [GMG Functional Safety for Autonomous Equipment](#) project doing?\*

### WHAT IS FUNCTIONAL SAFETY?

Functional safety is defined as *part of overall safety of a system or piece of equipment that depends on automatic protection operating correctly in response to its inputs or failure in a predictable manner* (Informal definition from IEC 61508-0 3.1).

The automatic protection system needs to be designed to handle several types of errors and conditions including human errors, software failures, hardware failures and operational and environmental stress.

For example, if there is a hardware failure in an autonomous truck's steering system the layers of protection in the autonomous system need to ensure the truck stops safely. Similarly, if an autonomous truck is hit by lightning, the safety system should be sufficient to bring it a safe stop.

While functional safety is critical, it is only one of several interrelated layers of safety involved in overall safety management (Figure 1). These layers include technologies, people and business processes.

## Overall Safety Management

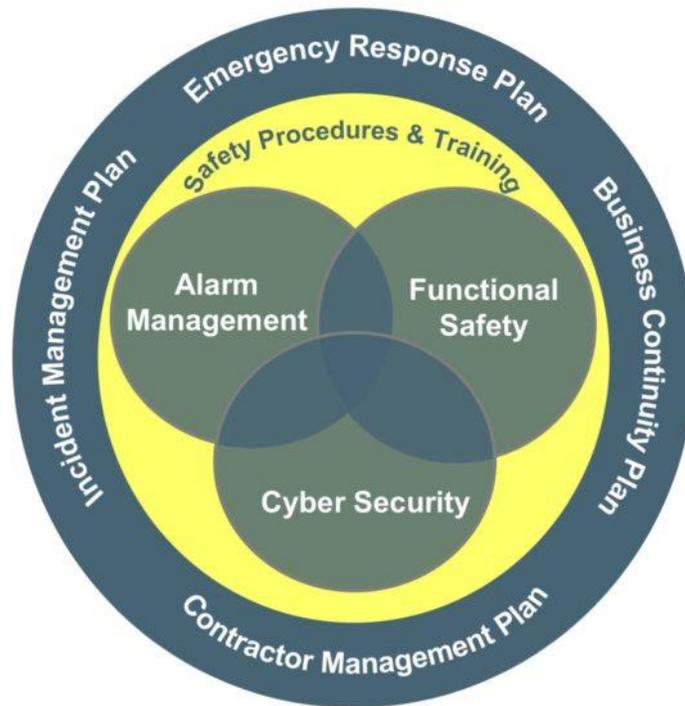


Figure 1 Visualization courtesy of Chirag Sathe – Principal Risk & Business Analysis Technology, BHP

## CURRENT STATE OF FUNCTIONAL SAFETY FOR AUTONOMOUS MINING EQUIPMENT

### Problem Statement

The industry is not aligned. Available international standards applicable for mine autonomy are not clearly defined and the requirements for managing functional safety are therefore unclear.

### Current Status

Mobile automation is still in the forming stages of development. As a result, original equipment manufacturers (OEMs) are still evolving and are at different stages of maturity for managing



functional safety. There are also currently no standards *specifically* for automating mining equipment. Because it is not clear what standard to follow, regulatory authorities might not be able to provide specific guidance on the requirements for functional safety.

## THE GMG PROJECT SCOPE OF WORK

The GMG Functional Safety for Autonomous Equipment subcommittee has three primary components:

1. Providing an industry platform for sharing lessons from near-misses to manage functional safety
2. Developing guidelines for:
  - a. A common framework for managing functional safety
  - b. A cross-acceptance process for certification of systems or applications
  - c. Industry alignment on expectations and requirements for functional safety
  - d. A standard set of safety functions and parameters
3. Producing a white paper on the common purpose of standards, including their constraints

*For more information about the project and how to contribute, please contact GMG Program Manager David Sanguinetti, [dsanguinetti@gmggroup.org](mailto:dsanguinetti@gmggroup.org)*

*\*This article is based on information presented in a knowledge share by one of the project group co-leaders, Chirag Sathe – Principal Risk & Business Analysis Technology, BHP on a March 13 teleconference for the Autonomous Mining Working Group*