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GROWING OUR COMMUNITY

Thanks to incredible collaborative efforts from our members and participants, many projects have reached important milestones, we have held events spanning four continents and participation is growing.

In the past couple months we published two guidelines – the third, and most substantial, part of the underground communications infrastructure suite and a guideline on implementing autonomous systems. We are offering short courses and webinars based on them. These guidelines are terrific resources for mining companies embracing new technologies. They are tangible evidence of the immense collaborative work that our volunteers have been doing this past year. These projects aren’t over yet though: the next step is implementing them to show how this collaborative work translates into industry benefit. I encourage you to share case studies and feedback.

Our newer projects have also been generating a lot of engagement and participation. The Functional Safety for Autonomous Equipment project has made great progress in the development of their first guideline. As with many projects getting alignment in thinking of all the participants is the first and most important step. I believe that this project however is of enormous importance to our industry as we move into a fundamentally new way of operating our mines, one with demonstrably more positive safety, health and environmental outcomes but one in which we don’t have the immediate ability for people to take physical control if something isn’t operating as intended.

The Foundations for AI in Mining project has also developed a significant portion of the content of their high-level educational document and collected several use cases. This project has been requested by so many of our members as we all progress to a more predictive future where the insights that AI can give us to help augment the capabilities of our people becomes real. There have already been many success stories in our industry with effective use of AI in exploration and processing, to name but a few. This project should help us all engage with and implement these technologies significantly faster, learning from the successes and failures of others and technology experts.

We have also launched a new initiative: The Interoperability & Functional Safety Acceleration Strategy (IFSAS). An aggressive schedule and intense stakeholder engagement are needed to align mining companies on interoperability and functional safety. You can read more about it on p. 8.

In Q1, we have worked on expanding our reach in South America, establishing a Latin America Steering Committee and planning several South American events, as you will see on p. 7. GMG Forums were held in three regions – Adelaide (Australia), Luleå (Sweden) and Johannesburg (South Africa) – which shared focuses on autonomous mining, data and interoperability, and AI. It is notable that similar experiences and focuses are constant globally.

We have seen outstanding growth in participation since December, up by more than 300 participants in our working groups, projects and events. I welcome and look forward to working with Komatsu, Anglo American and Teck, who have joined the Leadership Council, and collaborating with our newest members: Endress + Hauser Group, Gold Fields, Kal Tire and New Gold.

With our growing community we are that much closer to achieving the innovative and safe mining industry we all are striving for.

Michelle Ash
GMG Chair
NEW INDUSTRY GUIDELINES

The industry just got hit with a couple new guidelines:

*Underground Communications Infrastructure Guidelines, Part III: General Guidelines* provides a high-level view of processes needed and walks the user through tasks and components required to meet planning and design requirements for creating and replacing underground communications infrastructure. Read more on p. 20.

*Guideline for the Implementation of Autonomous Systems in Mining* provides a high-level framework for mining stakeholders to follow when establishing autonomous mining projects at varying levels of maturity and scope and describes common practices. Read more on p. 13.

FOUNDATIONS FOR AI IN MINING PROJECT LAUNCHED

In January, the AI Working Group launched its first project. The Foundations for AI in Mining project aims to provide a unified understanding and framework of the basics of AI in mining that cuts through the hype, clarifies what methods are useful and identifies how they can be applied.

The output will be a document to assist mining companies with successfully implementing AI techniques within their business. This includes:

- Discussion of the terminology surrounding AI
- The high-level steps needed to introduce AI into an organization
- A maturity model to enable companies to plan their AI strategy
- Common case studies and use cases that highlight the variety of processes that can be transformed using AI enabled technologies

Since the project launch, there have been several teleconferences and workshops. Content development is underway, including the development of several use cases.

If you would like to participate in this project, please contact Program Manager David Sanguinetti: dsanguinetti@gmggroup.org
UPDATES ON INTERNATIONAL STANDARDS

ISO TC82/SC8

Joint Working Groups (JWGs) held meetings during the last two weeks of March 2019 in San Jose, California:

- ISO 21815 Collision Awareness and Avoidance: Collision Avoidance held its latest JWG development session on March 18-22 and the standard is currently in the initial stages of development. The project has been registered, and the next stage is to develop the working draft. The next meeting is tentatively scheduled for the week of October 14 in Australia.

- ISO 17757 Autonomous Machine Safety: SC8, as part of the JWG, will participate in planning the next version of ISO 17757 in 2019. Some planning took place on March 25-26, and the current plan is to advance several specific areas of the standard (e.g. data, functional safety, safety signs). The GMG Functional Safety for Autonomous Equipment project should provide strong input into its content. The next meeting is expected for October 2019 in Australia, the exact dates and location are to be confirmed.

- ISO 23724 Remote Stop Function for Mining Equipment: The first scoping sessions were on March 27. The next development sessions are scheduled for the week of October 7 in Australia.

- ISO 23725 Fleet Management System Interface and Autonomous Haulage: The first scoping session was held on March 28-29. The initial draft scope is currently being documented and should be available in April 2019 for distribution within the working group. The next development session is scheduled for the week of October 7 in Australia.

The next plenary meeting for TC82 Mining and TC82 SC8 is the week of September 23 in Stockholm, Sweden.

ISO TC 251


ISO 55010, Guidance on Alignment of Asset Management, Finance and Accounting, is now progressing to Final Draft International Standard (FDIS) stage. It should be released at this stage at May’s meeting in Nanjing.

ISO 55011, Guidance on the Development of Government Asset Management Policy, is currently in the Committee Draft stage and will be discussed in Nanjing with a view to releasing it in Draft stage.

The Australian Mirror Committee (MB-019 Asset Management) has a representative on the newly formed ISO Task force group (TF14) for the ISO virtual standards development process. The role of this group is to revise the ISO template of the Management System Standards. This will ensure Asset Management professionals are consulted and have design input into the future of the Integrated Management System. Regular updates will be provided to GMG as the project proceeds.

The dates of the next two meetings have been confirmed:

- May 6-10, 2019 in Nanjing, China
- November 4-8, 2019 in Quito, Ecuador

DID WE FOOL YOU?

In case you missed it, on April 1 we launched a new project on teleportation technologies in mining, to address growing concerns over privacy, cybersecurity and data ownership. Read the press release [here](#).

Thanks to everyone who took the time to write us – we heard from well over 100 people. Your comments had us in stitches!
INTERVIEW WITH GMG’S NEW VICE-CHAIR

Kalev Ruberg, Vice-President Digital Systems and Chief Information Officer (CIO) at Teck Resources Limited (Teck), will become the new GMG Vice-chair on April 30. We asked him some questions about his experience and his vision for the future.

Why did you take on this role?

GMG continues to evolve as the premier open forum for debate, information sharing and guideline development for innovation in the mining industry. GMG has also brought industry stakeholders together to develop open technology standards and approaches. The group comprises many of the most innovative minds in the industry to foster open, collaborative and shared innovation. The leadership of current Chair Michelle Ash has been formative and instrumental in the recent introspection by the mining industry and its fundamental shift in how technology is used in mining.

It is an incredibly exciting time where both the digital technology industry and mining technology are changing faster than mindsets. Meanwhile, grades are declining while environmental and community standards become ever more challenging to meet. GMG is positioned as a driving organization in the industry to share and develop information to hasten the industry’s adoption of technologies, and it is very exciting to play a role in the organization that is a key change agent.

Could you describe a bit about your experience and how it will help you in this role?

I’ve been in the digital technology business since 1978, and before that, I was at MIT working with the Architecture Machine (aka. the Media Lab). The value of research as applied in industry has been a recurring theme in my work as a research scientist in the US National Laboratory system and at the National Research Council of Canada, and then as an assistant professor at Georgia Tech.

Throughout my career, I have had great opportunities to participate and lead some of the most innovative applications, using machine learning in the manufacturing context. I have also had the experience of leading large technical organizations in Government as a Deputy Minister and now digital teams in the mining industry, both at Placer Dome and Teck Resources. While this breadth and depth have developed insights into the digital and mining industries, it has also left me with a desire to move the mining industry into a new era through the use of technology.

How do GMG and Teck values align?

Teck’s values are consistent with industry and GMG values: workplace safety, community welfare and protection of the environment rank highly at Teck. GMG, its members and Teck recognize that technology and innovation are transforming the mining industry and that it’s important to foster collaboration across the industry to make our operations more productive, sustainable and safe. Teck is doing that through innovations such as using shovel-mounted sensors at our Highland Valley Copper Operations and leveraging big data and machine learning to identify maintenance issues in our haul trucks.

What do you see as the greatest challenge the mining industry will face in the near future? What will GMG’s role be in facing it?

Michelle has succinctly described many of the challenges in mining, but one which stands out is her assertion that “the process has not changed much since my grandfather’s days.” With ever-increasing environmental constraints, energy restrictions and water conservation demands, the industry must be willing to take technology risks and learn fast when things don’t quite work out. These risks may take us all out of our comfort ranges in terms of questioning how we process ore. For example, comminution is one of, if not the, largest and least efficient energy sinks in the process. Is there a radical approach to pulverizing rock? There are approaches from the work Vale has done using AI to understand the contributing factors to inefficiencies to using EMP. These are nascent and small examples. How do we build on these to test practicality? From these process-based questions to questions of what part blockchain technology can, or should play, there is a spectacular range of questions that GMG can help answer.
The one thing that drew me to the industry was the abundance of opportunity to make mining better. Almost anything we do has a positive effect. How do we work together to get a really big effect? That’s the wonderful challenge.

What are your primary aims in this role and in your future role as GMG Chair?

GMG has brought together the OEMs, OTMs, miners, geologists and players from all parts of the industry. How do we focus on a number of challenging issues for the industry and bring in focused research? Three thoughts:

• Work openly with a select number of university groups to draw them into research that has great risk, but immense reward; for example, in the comminution area, water treatment domain, or in the community engagement arena. As part of GMG, they are free to question our traditional assumptions.

• Share information through more traditional channels like CIM, SME and events under the GMG banner to develop guidelines for baselines and benchmarks, and openly share them.

• Aggressively seek open data interchange agreements, if not standards. That the OEM members of this group are helpful and provide access to data generated by their specific IoT and sensor deployments.

These are very preliminary and raw thoughts, and I would expect GMG to guide the agenda of the group. It’s a journey I anticipate with joy!

THE GMG COMMUNITY CONTINUES TO GROW

New to Leadership Council

Anglo American
Komatsu
Teck

General
Endress + Hauser Group
Gold Fields
Kal Tire
New Gold

UPCOMING EVENTS

MAY 1   Al in Mining Forum
        Montreal, Canada

MAY 2   Al in Mining Workshop
        Montreal, Canada

MAY 22-23   Tucson Forum
              Tucson, USA

MAY 27   Mobile Equipment Open Data Workshop
          Perth, Australia

MAY 28   Mining Companies Interoperability Alignment Workshop
          Perth, Australia

MAY 29-30   Open Mining Format (OMF) Workshop
              Vancouver

JUN 5   Functional Safety for Autonomous Equipment Workshop
        Santiago, Chile

JUN 6   Al in Mining Workshop
        Santiago, Chile

JUN 12-13   Sudbury Forum
               Sudbury, Canada

JUL 8   Lima Forum
        Lima, Peru

JUL 10-11   Santiago Forum
               Santiago, Chile

AUG 14-15   Perth Forum
             Perth, Australia

OCT 1-2   Edmonton Forum
          Edmonton, Canada

OCT 22-23   Leadership Summit
               Tucson, USA

OCT 23   Leadership Council Meeting
          Tucson, USA
GMG LAUNCHES FOCUSED EFFORT TO SOLVE INTEROPERABILITY & FUNCTIONAL SAFETY

GMG has launched a new Interoperability & Functional Safety Acceleration Strategy (IFSAS) to facilitate collaboration to solve interoperability, funded by BHP and Rio Tinto. The future of mining is digital and requires interoperability to be realized. Advanced digital technologies are enhancing – and in many cases revolutionizing – equipment, processes, planning and execution. To make this future happen, we need common definitions, standards, language, decision-making criteria and data exchange capabilities to change how people, equipment and software work together.

Interoperability

Ultimately, interoperability will lead to more productive, safe and cost-effective mines. The benefits are well-known. For example:

• Interoperability is key to meeting the data requirements for and benefiting from advanced digital technologies like artificial intelligence, machine learning and autonomous systems.
• Improved productivity from interoperability will encourage broader implementation of autonomous technology, removing workers from hazardous environments.
• Interoperability will facilitate greater innovations that drive environmental outcomes, making our products more useful in building a better society.
• Interoperable onboard systems will limit the time lost in maintaining and managing many separate systems and the centralized information will improve situation awareness.
• Interoperability enables modular architecture, bringing in new suppliers with niche expertise.
• Increased choice and competition can lower the cost of autonomous technologies while standardization can lower costs for suppliers.
• A more advanced level of interoperability will make projects for developing fully integrated supply chains meet their full potential.

Communications and industry engagement will be key – you can’t solve interoperability in a vacuum. At this early stage, the aim is to achieve operator alignment on interoperability and to develop a robust strategy to move the industry forward together. To that end, we are starting by building a mining company executive leadership committee. Once we have a unified mining company vision, we will expand to include broader industry perspectives.

A second priority is to support and leverage the many existing projects and organizations already tackling these issues and work with their leadership to deliver the best possible solutions. GMG is reaching out to many organizations with current interoperability projects to define the landscape and align global efforts.

Achieving alignment on interoperability will open doors for the industry and help companies meet their integrated mining goals and technological roadmaps. With the right kind of focused effort, we know it is possible. The more global industry voices working in collaboration, the more likely we are to succeed.

Functional Safety

Alignment on interoperability will also enable greater levels of functional safety, especially for autonomous equipment and robotics from various suppliers. Reducing and managing risks is an essential part of the move toward greater autonomy and robust and structured functional safety is essential for protecting our people and communities.

Right now, international standards applicable to mine autonomy are not clearly defined and the requirements for managing functional safety are unclear. While autonomous systems have many safety benefits, they require many interoperable layers of protection.

GMG has already launched the Functional Safety for Autonomous Equipment project to meet this need for alignment. The project aims to provide an industry platform for sharing lessons from near-misses, develop guidelines for managing and understanding requirements, and produce a white paper on the common purpose of standards, including their constraints.
A LIVELY COMMUNITY
WORKING GROUP PROJECTS

GMG Working Groups are communities of interest focussed on mining industry topics or fields. GMG Projects are focussed efforts that produce tangible guidance for the benefit of the global mining community.

Participate!
FOUNDATIONS FOR AI IN MINING

Working Group: Artificial Intelligence

GROUP LEADERS: Mark O’Brien, CITIC Pacific Mining & Mohammad Babaei, Teck
PROJECT LEADER: Rob Johnston, Project Manager, CITIC Pacific Mining

The goal of this project is to articulate a clear and unified understanding and framework of what artificial intelligence (AI) is and how it can benefit the mining industry. There are three key components:

1. A glossary for AI in mining so that everyone is using the same language
2. An outline of what is required for a mining company to use including data requirements, infrastructure requirements and change management and cultural requirements
3. Case studies that demonstrate what is achievable

UPDATE

After the project was launched at the beginning of the year, the project group has:
• Created the initial table of contents that includes the transition to an AI-enabled mine, implementing AI and applications of AI
• Identified members of mining companies with some existing AI knowledge who are tasked with introducing or further enabling AI in their companies as a primary target audience
• Crafted several use cases and case studies that cover practical applications
• Worked on developing a plan for local meetups (i.e. micro-workshops)

Project Stages

Draft creation (Jan-Jul)
Working group review (Jun-Jul)
Publication (Aug)

Activity & Engagement

WORKSHOPS = 3
CALLS = 5

83 participants from 11 countries

FUNCTIONAL SAFETY FOR AUTONOMOUS EQUIPMENT

Working Group: Autonomous Mining

GROUP LEADERS: Gareth Topham, Rio Tinto & Chirag Sathe, BHP

International standards applicable to mine autonomy are not clearly defined and hence requirements for managing functional safety are unclear. The project aims to not only clearly define what functional safety is for mobile autonomous equipment, but also identify who is responsible for it, create a collective view of minimum requirements, and present guidance on testing and verifying it. Additionally, the project will define an industry platform for sharing lessons learned from near misses to enable better risk management and provide guidance on how to apply existing functional safety standards to autonomous mining equipment.

UPDATE

Development work is ongoing on the first guideline which:
- Lists standards for various aspects of mobile mining equipment automation
- Provides guidance around the functional safety lifecycle and process for the different types of stakeholders
- Clarifies the expectations and ownership of a functional safety management plan

Workshops were held in Perth, Edmonton and Sudbury that advanced work on the draft guideline, especially on the list of standards and the functional safety lifecycle. The next workshop is planned for Santiago in June.

Activity & Engagement

WORKSHOPS = 3
CALLS = 1

94 participants from 11 countries

In April, GMG published the Guideline for the Implementation of Autonomous Systems in Mining. The document offers a broad view of the implementation of these systems, which are being used more and more frequently due to their potential for making the mining industry safer and more productive.

The guideline provides a high-level framework for mining stakeholders to follow when establishing autonomous mining projects at varying levels of maturity and scope and describes common practices. It also offers guidance on how stakeholders should approach autonomous mining, promoting collaboration between involved parties. More specifically, the publication addresses: change management; developing a business case; health and safety and risk management; regulatory engagement; community and social impact; operational readiness and deployment;

As a high-level reference, companies can use this guideline to know what to look for and to assess what their journey towards autonomy will look like.

Thank you to the hundreds of volunteers who dedicated their time and expertise to creating this guideline. A special thank you to the project group leaders and steering committee members that includes: Mark Baker, CheckMark Consulting; Alex Bals, Trimble; Dylan Bennett, Teck; Chad Chaffin, ORICA; Peter Cunningham, Teck; Michael Diering, Nevsun Resources; Francois Gariepy, Teck; Peck Tech; Sharna Glover, BHP Billiton; Dave Goddard, McKinsey; Cheryll Godwin-Abel, BHP Billiton; Helius Guimarães, Alcoa; Glenn Johnson, Teck; Sue Keay, CSIRO; Giel Marais, De Beers; Paddy Marshall, Maclean Engineering; Alastair Mathias, Rio Tinto; Matt Miller, OISofT; Graeme Mitchell, BHP Billiton; Michael Murphy, Caterpillar; Peter O’Loughlin, Department of Mines, Industry Regulation and Safety (DMIRS); Chirag Sathe, BHP Billiton; Andrew Scott, Symbiotic Innovations; Tim Skinner, SMART Systems Group; James Swanson, Hatch; Dean Tanaka, Teck; Gareth Topham, Rio Tinto; Gary Westerdale, Sibanye-Stillwater

DATA EXCHANGE FOR MINE SOFTWARE: OPEN MINING FORMAT

Working Group: Data Access and Usage

GROUP LEADERS: Rob Ferguson and Samuel Bain, Seequent

The Open Mining Format (OMF) is an open-source file specification for 3D data interoperability that will eliminate the time required for manual and convoluted data transfer across the mine site. It aims to enable different technology systems and software applications to connect, communicate, exchange and apply data across a mine. The first version covered basic structures (points, lines, surfaces, meshes and volumes). The second version will add block models to the format.

UPDATE

OMF 2.0 launched in February with the active participation of five mining software companies. Since then, significant work has been done on a python implementation. Once that is complete, it will be translated to C++ to make it accessible to more software companies. In parallel, a marketing program to make the industry more aware of the value of OMF 2.0 will be developed. Mining company representatives on the steering committees are developing a letter of intent to let industry suppliers know they want to use it.

Other next steps include:
- Developing more extensive documentation
- Changing the file format to use a zip-based container
- Investigating supporting more parametric types
- Considering drill holes for the next version

Project Stages

- Python development (Mar-May)
- C++ development (Jun-Jul)
- Develop letter of intent (Jun)
- Launch marketing group (Jun)
- Review & testing (Aug-Sept)
- Finalization & launch (Oct-Nov)

Activity & Engagement

WORKSHOPS = 1    CALLS = 4

146 participants from 13 countries


Canada

U.S.

Australia

Other

76 participating companies
MOBILE EQUIPMENT OPEN DATA CONSENSUS VERSION 2.0

Working Group: Data Access and Usage

This guideline aims to establish a common vision around the principles and guidelines for the permissible access and use of mobile equipment data across the mine cycle, including both open pit and underground, for the purpose of increasing safety, optimizing operational efficiencies and improving life-cycle management of physical assets.

Project Stages


UPDATE

Based on working group feedback to the most recent draft, further engagement is required between original equipment manufacturer (OEM) and mine operator stakeholder groups to achieve consensus on the principles for open data. While there was agreement on the general philosophy for manned equipment, autonomous systems are much more complicated and further engagement is required.

- OEMs have expressed concern over the potential intellectual property loss associated with providing certain data to third parties that have access to autonomous control systems.
- Mine operators want access to the data from equipment that they own and want the ability to directly access data from sensors if no connection is provided. They also want to be able to input data to a piece of equipment.

Workshops are being developed to bring OEMs and mine operators together to focus on understanding each other’s concerns and requirements.

Activity & Engagement

15 participants from 5 countries

Caterpillar, Epiroc, ETF Mining Equipement, Hitachi, Maclean Engineering, Prairie Machine & Parts, Sandvik, SMS Equipment, Teck
OPERATIONAL KPI’s AND DEFINITIONS

Working Group: Data Access and Usage

GROUP LEADER: Zoli Lukacs, Advisor, Asset Optimization

This project takes a consensus approach to enable a common basis for production reporting and performance comparisons. To this end, a guideline is being developed identifying common surface mining events, statuses and activities and providing guidance for classifying them into time categories. These time categories making up a consensus-based Time Usage Model, which can in turn be used to generate operational KPIs for reporting mining asset availability and utilization.

UPDATE

The Time Usage Model is complete and has been reviewed by a selected stakeholder group to ensure alignment with automated data collection systems and autonomous operations and modified to reflect feedback.

The draft guideline is complete and is now in editing. It currently includes:
- Descriptions of how the components of the guideline enable performance improvement
- Definitions of standard time categories and what operational activities, events, and statuses are classified into them
- The consensus-based Time Usage Model and descriptions of how to use it
- Proposed standard definitions for common industry operational KPIs that can be generated using the Time Usage Model
- Recommendations for future work to further expand common definitions and KPIs across the mining industry

The guideline will be ready for working group review in the upcoming months.

Project Stages

| Project group input complete (Jan) | Draft finalized (Apr-May) | WG review (May) | Publication (Jul) |

Activity & Engagement

51 participants from 9 countries

40 participating companies

INTEROPERABILITY DEFINITIONS AND ROADMAP

Working Group: Interoperability

GROUP LEADER: Alvaro Rozo, HATCH

This project provides a foundation and common guiding framework for the international mining industry to move forward with interoperability. It takes a broad approach to accommodate interoperability’s holistic role in enabling the seamless integration of mining systems and technology. It includes development of a universal roadmap to enable greater coordinated efforts and industry-wide alignment in achieving mining interoperability.

Project Stages

- Definitions and terminology draft development (Mar-May ’18)
- Guideline development (May-Nov ’18)
- Working group review, stakeholder engagement, document revision (Nov ’18-Jul ’19)
- Publication (Aug ’19)
- Phase 2 project plan development (Aug + onward)

UPDATE

The draft guideline was completed and reviewed by the project group. The current draft prioritizes interoperability issues, presents a landscape of current interoperability projects and gaps across the value chain, and proposes a roadmap to achieve industry interoperability. Following the working group feedback, it was decided to make some revisions to how the information was presented so that it could be a more useful tool. To this end, stakeholder and steering committee engagement is required to integrate feedback and update the document.

Activity & Engagement

183 participants from 14 countries

BATTERY ELECTRIC VEHICLES IN THE UNDERGROUND

Working Group: Underground Mining

GROUP LEADERS: Craig Harris, Glencore

Providing operators and OEMs with the tools to solve the challenges associated with the transition from diesel to battery electric vehicles (BEVs), the second edition of this guideline offers updated commentary on several issues. These issues include emergency response requirements, required skill sets and training for maintenance technicians, and charger standardization recommendations. It also presents new material on different battery chemistries and alternate charging methods.

UPDATE

Version 2 of the guideline was published in November 2018. Since then, we held two short courses (one in Perth, one in Montreal) and gave presentations on it at a number of industry conferences. We are at the outreach stage trying to build awareness, building the structure necessary to collect and house case studies and gathering feedback that will feed into pipeline for the next stage of the project.

Activity & Engagement

243 participants from 12 countries
SHORT INTERVAL CONTROL

Working Group: Underground Mining

The *Guideline for Implementing Short Interval Control in Underground Mining Operations* is in its final stages before publication. Short Interval Control (SIC) is a structured system in which data from mining processes are periodically reviewed and action is taken in response to them. This guideline provides a roadmap to increase the speed and likelihood of success during SIC implementation while avoiding common pitfalls and presents options and best practices.

Technological advances and improved communications structure in underground environments have allowed for greater control and automation in underground mining, potentially increasing productivity and cost savings. Guidance is needed, however, because SIC has only recently begun to be used in underground mining contexts.

Specifically, the guideline:
- Identifies the value of implementing SIC in underground mining
- Presents a conceptual model of what SIC could look like that includes an operational framework, detailed workflows for SIC processes showing, and a maturity model showing how SIC supports progression from a manual system to a highly automated environment
- Describes a high-level implementation process

While SIC will ultimately look different for every mine, this guideline offers mining stakeholders a base of knowledge of the system and how it can be applied.

### Project Stages

- **Project plan development (Jul-Nov ’17)**
- **Guideline draft development (Nov ’17-Sept ’18)**
- **Project Group review (Sept ’18-Mar ’19)**
- **Working group review, stakeholder engagement, document revision (Apr ’19-May ’19)**
- **Publication (June ’19)**

### Next steps

We are developing a bank of case studies to demonstrate and share lessons learned.

### Activity & Engagement

- **150 participants from 14 countries**
- **92 participating companies**

![Activity & Engagement Chart]

- **Australia**
- **Canada**
- **U.S.**
- **Other**

- **Chile**
- **Finland**
- **Germany**
- **Ghana**
- **India**
- **Indonesia**
- **Japan**
- **South Africa**
- **Sweden**
- **Switzerland**
- **United Kingdom**

UNDERGROUND COMMUNICATIONS INFRASTRUCTURE GENERAL GUIDELINE

Working Group: Underground Mining

GROUP LEADERS: Dave Fry, Granite Technology Group

In March, GMG published Underground Communications Infrastructure Guidelines, Part III: General Guidelines. This document provides the reader with:

- An overview of the planning and design recommendations for underground communications development
- Some best practices used within mining environments
- Where to find more information on digital communications, standards, and frameworks

The underground communications infrastructure guideline suite was developed in response to the rapid development of industrial and communications technology in recent years. Overall, it provides a high-level view of processes needed and steps the user through tasks and components required to meet planning and design requirements for creating and replacing underground communications infrastructure.

While the first two parts, published in 2017, provide broader general context, this third part forms the core content of the guideline and can be used more directly. These general guidelines offer a solid foundation for companies to reference when selecting and implementing communications solutions underground.

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