GMSG Future Mining Forum Montreal: Building a Strategic Vision of Future Mining
Saturday, April 29, 2017

A collaborative GMSG forum was held in Montreal, which offered participants a chance to learn about ongoing GMSG Working Groups, and gauge the interest in future ones. Several engaging breakout sessions painted a picture of what the mining industry needs to do to succeed in terms of priorities, value drivers and innovations. The following is a brief summary of the day’s presentations and sessions.

Future Mining Strategy: Driving Innovation with a Collaborative Vision
Andrew Scott, Senior Director, Innovation, Barrick Gold

Barrick’s journey to following the commodity price drop in 2015 to become a leader in driving innovation and collaboration through an internal culture change:

- Barrick developed a digital transformation focus after facing pressure to maintain financial discipline and cut costs following commodity price drop in 2015
- Needed greater level of data visibility, cut down silos, which resulted in a changing of the culture within Barrick, with more focus on innovation and collaboration
  - Workers from all experience levels involved in culture change – many given opportunities to lead
  - Mine site GMs responsible for community, given ownership of the site, and aware of what’s happening at other sites – sharing culture – promotes engagement in the community – bottom up mentality
  - Became involved in collaborative groups - “innovation in isolation isn’t successful”
- Example of collaboration and innovation – participation in Hackathons
  - Attracting people from other industries who have little idea about mining, who are able to come up with good solutions to mining problems
  - Engagement with entrepreneurial communities and research processes
  - Outcomes feed into growth period
- Expected end of year deliverables:
  - Reduction in sustaining cost
  - Operating costs to survive any commodity price

Break-out Session: Driving Success – Priorities to Create the Most Value across Industry

In this first session, participants were asked to identify the critical priorities to create value across the mining industry. The following are key takeaways:

- Integrated operations
- Building communication network between companies/Cross-industry collaboration
- Reference framework/common languages and definitions
• Guidelines on technology adoption
• Modern management processes
• Exploration, discovery of new deposits
• Push for big data
• Effectiveness vs. Efficiency
• Innovation to benefit end user

Integrated Operations Action Plan
Laura Mottola, President, Flow Partners

The Integrated Operations Working Group is moving into the project delivery phase after a year of stakeholder consultation. Learn more about the group’s 2017 action plan:

• More than a year was spent to develop detailed work plan for the group with a focus on cost, safety, and profitability
• IO represents a movement toward one team environment (organization that behaves as one team) over current model of command/control structure, where there is a lack of cross-function
• Recently there has been a shift in industry conversation from why collaborate to why not
• Companies must share risks and benefits, need to pool resources and thinking to move faster
  ➢ GMSG as facilitator of collaboration
  ➢ Enabling conversations for industry at large
  ➢ Key enabler – spending time to do things right way up front
• Working Group now has scope, purpose, projects and timeline
• Action plan:
  ➢ Develop business case for IO
    ▪ Sub-committee being formed
    ▪ Six months for development
  ➢ Benchmarking study/literature review
    ▪ Complete by the end of 2018 – needs resources and planning
  ➢ Technology reference architecture
    ▪ To be used by multiple WGs with IO leading
  ➢ Phase two: best practices guideline

Battery Electric Vehicles Underground: GMSG Guideline Approval and Next Steps
David Sanguinetti, President, Sanguinetti Engineering Ltd.

An introduction to the newly published Battery Electric Vehicles guideline and a preview of the group’s next steps following publication:

• Benefit of BEVs:
  ➢ Move away from diesel fumes
  ➢ Reduce ventilation – safety benefits
  ➢ Equipment costs more, but other reductions make up for it, including energy costs
• Launched guideline in Sudbury, coordinated between GMSG and CMIC, as there were no current existing standards for BEVs, just a growing commitment to move mines to electric
• Purpose of the guideline is to inform of what’s available to OEMs and mining companies
• Important to work with compatibility without stifling creativity – mines must be designed around electric, rather than vice versa
• Next steps:
  ➢ Mining company consortia to develop a joint RFP for battery electric vehicles (LHDs and trucks), divide bids between companies – giving OEMs between 2018 to 2020 to develop equipment – mining companies to share data with one another, compare notes on equipment
  ➢ Development of a second edition of the guideline to begin in early 2018, will take feedback from readers of the guideline

**Underground Mining Innovation: Communications Infrastructure and the Digital Mine**

*Andrew Scott, Senior Director, Innovation, Barrick Gold*

An update on the Communications Infrastructure sub-committee, who have recently published Sections 1 and 2 of their guideline:

• Sub-committee needs new volunteers and stakeholders - more people needed to build next phase documents
• Discussions on security, new technologies
• Capture info to communicate between different stakeholder groups
• Barrick is one of the companies that has invested in wireless

**Block Chain Methodology**

*Helius Guimaraes, GMSG Chair*

GMSG is in the consideration process of developing a new Working Group around developing the capability to track commodities from source to end use, potentially through block chain methodology, which was presented at the forum:

• Focus on chain of custody
• Example: 62 elements found in a cell phone - Consumers care about where the metals come from in their phones, but there is currently no way to track that - Companies like Tesla interested in more visibility on where metals come from
• No industry-wide initiative to look into this due to the fact that the lack of tracking technology was once a barrier – no longer the case
• Is it worth setting up a working group? Group vote indicates – yes
• Next step: Must demonstrate the process and benefit

**Autonomous Mining: Global Guideline Development**

*Heather Ednie, GMSG*

An update on GMSG’s Autonomous Mining Working Group, which has begun its 2017 work on four major projects:

• Outline of the current projects for the working group:
  ➢ Vision of Autonomous Mining:
    ▪ Needs to articulate list of scenarios of autonomous mining
Many different ideas of what autonomous is

- **Autonomous Mining Definitions**
  - Starting points – Western AU guideline, ISO
  - Develop clear definitions on autonomous mining
  - Compiling list – understand how to find the right definition
  - Look into outside industries to develop definitions

- **Focus on Scope and Deliverables**
  - Discover what companies need in regards to autonomous mining
  - Survey to be distributed around mid-May – going to GMSG community and companies not yet involved, used to build network beyond the boundaries
  - What resources and tools will bring value?

- **Implementation Guideline**
  - Focus on end use of the guideline, communication with regulators, plus internal communications
  - Building business case, understanding aspects to consider and sharing best practices

**Break-Out Session: Elements of the Autonomous Mine**

Participants were split into two groups to identify as many elements of an autonomous mine as possible. The following are the two mind maps that resulted:
Elements of Autonomous Mining

Automation Backbone
- Single point of failure
- Data correlation
- Fiber
- Remote operation
- A.I.

Change Management
- Integrated operations
- Cultural change
- Re-skilling
- CSR
- Schedules
- New incentive plan
- Workforce contracts
- Cohabitate
- Autonomous-only areas
- 3D to virtual reality
- All mobile equipment
- Variability reduction
- Cross-function data share (Ops - maintenance)
- Multi-OEM fleet
- Ability to go manual

Investment
- OEM business case
- CAPEX
- ROI on autonomy
- OPEX
- Partnership
- Upgrades
- Hosting
- Equipment

Sensors
- Hosting
- Equipment

Infrastructure
- Equipment management system
- Network/IT

Regulation
- Safety
- Lobbyists
- Who is the governing body
- Who is responsible for failure

Cybersecurity
- Hacking
- Who owns the data

Scope of what to automate
- Variability reduction

Interoperability
- Standardization
- Multi-OEM fleet
- Ability to go manual
Interoperability Working Group: From Concept to Action, Scope and Projects Strategy Ready for Roll-Out

Laura Mottola, President, Flow Partners

An update on the Interoperability Working Group, which is moving into the project phase after a series of stakeholder consultation workshops held all across the globe:

- 3 Phase One projects (drafts to be completed by year-end) identified through series of workshops held globally in Q1:
  - definitions (develop a common language)
  - develop a bank of case studies and use cases
  - Identify or develop a common reference framework (with collaboration with Integrated Operations and Autonomous Mining Working Groups)
- CORFO partnering with GMSG to lead work
- Key dependence on autonomous mining for everything to work

Measuring the Impact of Innovation and Technology on the Enterprise

Tom Struttmann, Group Executive, Mining, Alight

How to quantify the risks and processes when taking on new innovations within your business through the lens of the mining industry:

- Delivering solutions through the impact on value chain by the technology put in production and seeing impact of enterprise
- Speaking the language of the board and the CEO in asset value, stock price and raising capital
- Understand the drivers that make a difference: productivity, reliability, utilization
- Best practices in running scenarios - comparison of base scenario and new scenario
- Factor in all process of the operation
- Consistency in details, level of granularity
- Consider downstream effect of entire business

Discussion Forum: Value Drivers for Innovation

Participants were asked to identify the value drivers for innovation in groups. The key values identified are:

- Survival/Necessity
- Profitability/Economics (decrease cost to end consumer)
- C-level imperative
- Shareholder value
- Social license
- Risk mitigation
- Attract talent/employment engagement
- Agility
- Productivity

For more information on GMSG’s ongoing projects and events, visit www.globalminingstandards.org or contact Heather Ednie.