CMIC’s 4th National Mining Innovation Forum

The future is in your hands

June 8th Toronto
Context & Overview

1. The prevailing mining model is breaking down.
2. What is the problem.
3. Why innovate now.
4. In practical terms where should we start.
5. New design rules for the mining industry.
7. Roadmap moving forward.
A Century of Innovation

1930

Productivity

Today
What has the mining industry been trying?

Manufacturing controls the work environment such that automation is possible...

...and the mining industry must think the same way in order to automate and drive a step change in productivity and mining intensity.

Source: MDM Mining Consulting
Mining industry context – 2015

The industry was focused on cost cutting & reshaping portfolios ....

... and now it’s time to turn to the strategic application of technology.
Need For Innovation – **Cost Escalation**

- Long term trends in costs escalation impact every aspect of mining business

Source: www.infomine.com
Traditional Mine Design

Most are unaware and those that are ... are not sure what to do!

Design principles - Example
1. Continuous before automation
2. Design the shaft to go to the draw pt.
3. Quality not cost
Multiple Challenges In Mining

- Ability to find new deposits
- Complexity of ore grades
- Declining ore grades
- Deep mines
- Energy cost/efficiency
- Regulatory pressures
- License to operate
Draft Technology Development Roadmap

Phase 1
- Continuous and Automated Mining
  - Quick wins with existing technology

Phase 2
- Ore processing and recovery
  - Combining tech in new and creative ways

Phase 3
- Real-time - Smart - Digital Mine
  - Technology development

Theme 5
- Industry collaboration on T&D

Theme 4
- Mining in remote locations

Theme 3
- Merging of Mine & Mill into one discipline

Theme 2
- Continuous and Automated Mining

Theme 1
- Ore processing and recovery

Industry collaboration on T&D
From the Roadmap, 7 key focus areas were identified:

1. **Continuous Ore Extraction process**
   
   1. Continuous mucking
   
   2. **Mechanical cutting for development**

2. Consistent product
3. Real-time sensing
4. Real-time visualization to drive better decisions
5. Remote locations
6. Efficient collaboration ecosystem
7. Electrification
Continuous Mining System

1 & 5

Eliminate oversize in the draw point

2 & 5

Muck continuously

3 & 5

Transport continuously

4 & 5

Hoist continuously
Continuous Mining Workshop

• 5 Projects defined incl. continuous development and continuous mucking

Objectives:
• Increase development rates from 4 m/d to 15 m/d
• Increase mucking equipment productivity from 24% to 80%+
Continuous Mining Workshop

• Project participants include miners, OEMs, and consultants
• Collaborative approach across the supply chain, with all data being shared
• All participants contributing to the projects with ”skin in the game”
Underground Electrification Workshop

Converting underground equipment from diesel to electric

• Air quality, GHG, & health benefits
• Reduced ventilation requirements results in net reduction in electric load: less diesel consumed AND less electricity!
• CMIC working with CIM’s Global Mining Stds Group
Conclusions

• Innovation is the only way break the spiral of decreasing productivity
• Collaboration across industry and across sectors is req’d: Miners, Suppliers, Government
• Headway is being made but much remains to be done