SUDBURY
INTEGRATED NICKEL
OPERATIONS

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The Intersection of Safety and Innovation

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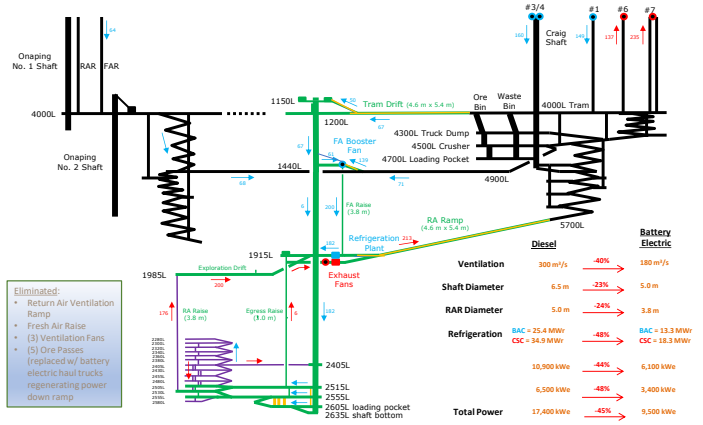
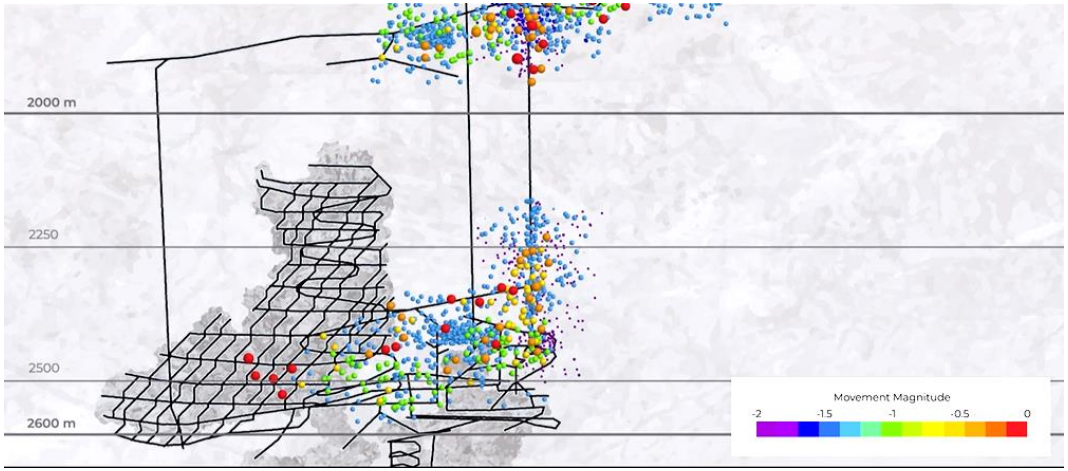
April 2021

Overview

- What are the challenges at Craig Mine - Onaping Depth Project
- The innovation process we are using
- The industry has made progress to improve safety over time
- Challenging our paradigms/mindsets
- Enrolling the external environment to help
- Who are the players in the game developing equipment?

Battery Electric Vehicles – Onaping Depth

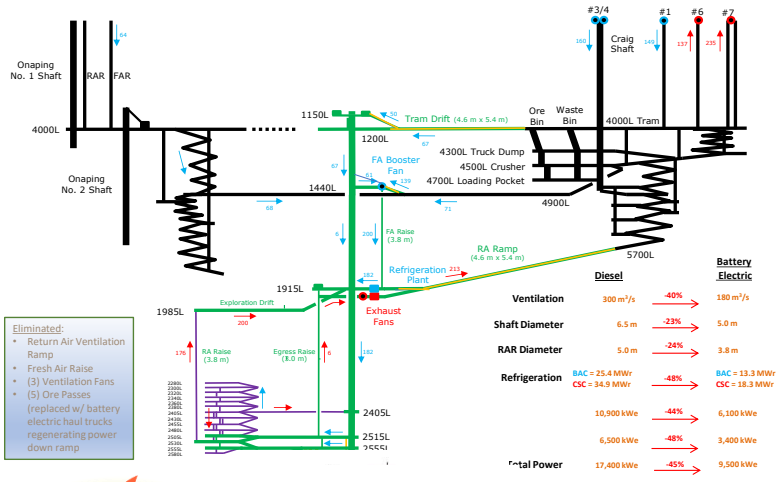




The Challenge at Craig Mine - Onaping Depth Project

In the face of a challenging operating environment - the question is…

Battery Electric Vehicles – Onaping Depth



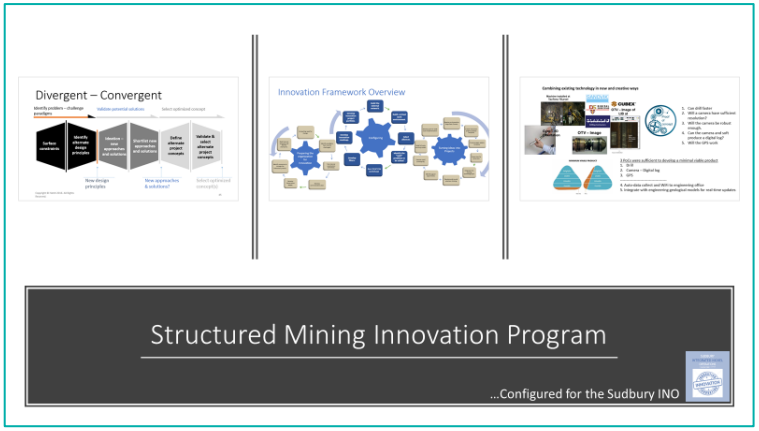
- Why are we taking people to the face?
- When we take people to the face - the issue is to protect people when they are there i.e. screen the face

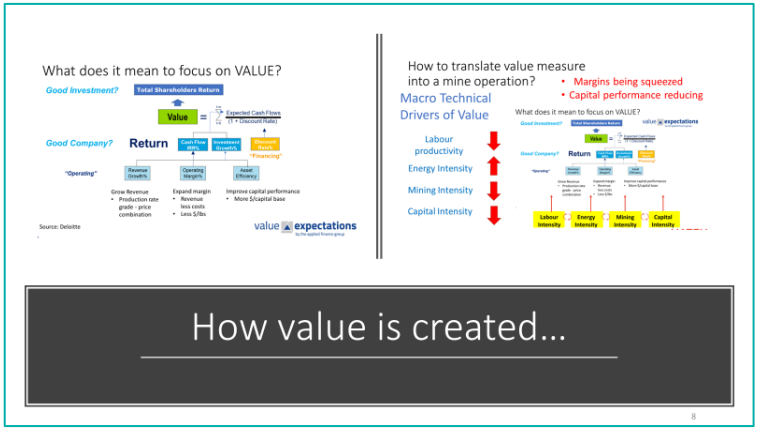
…how can we continue to ensure a safe environment?

How?

It’s not simply technology…

- Identify the key Problem to solve (not the symptom)
- Use a process (divergent-convergent)
- Discover technology(do not invent)
- Build an Ecosystem (to deliver results faster and cheaper)

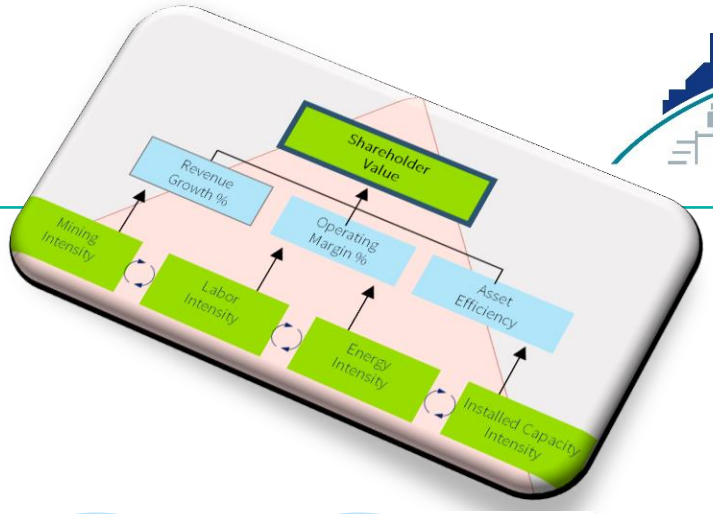




We are at the beginning of our journey

…it’s solving problems to ensure a safe work environment

Technology Portals



ONAPING DEPTH PROJECT

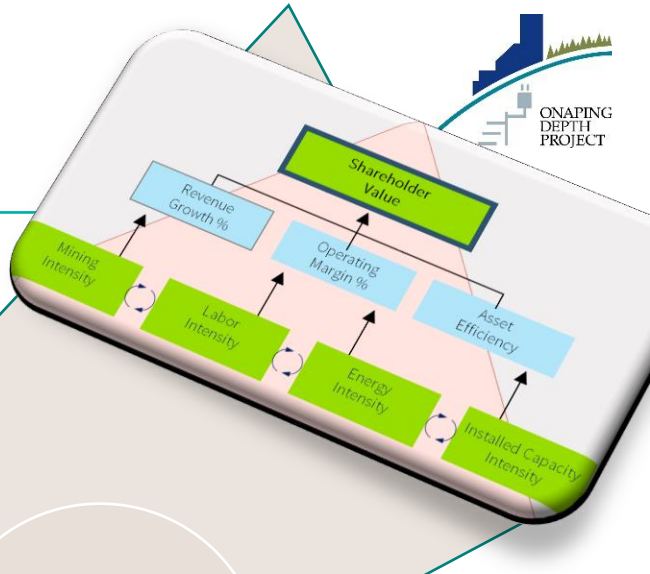
Unifiers across Translators

Energy | Water | Digital | Ecosystem

Value Translators

Find | Mine | Mill | Refine | Renew

Technology Portals



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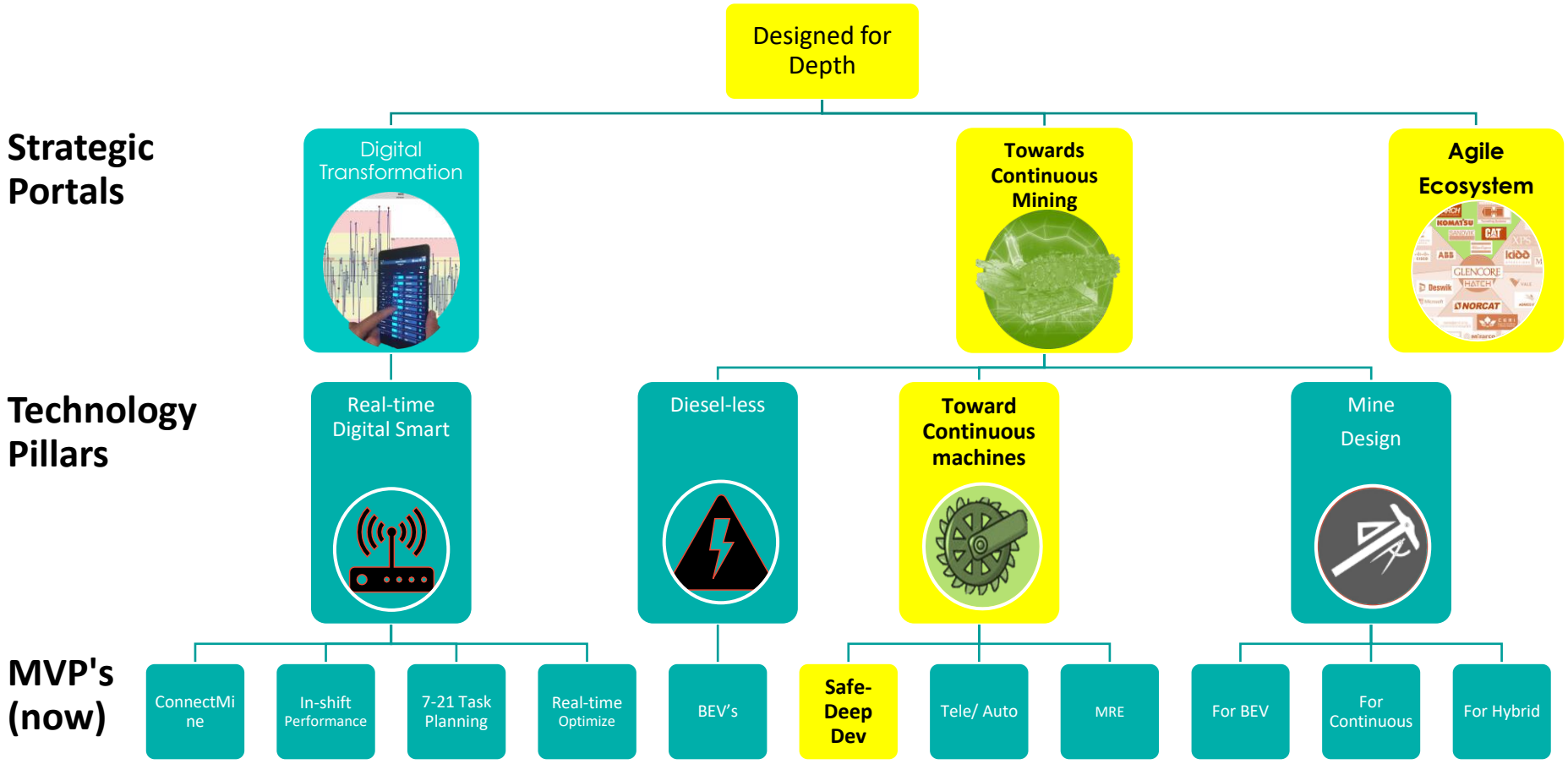
The Innovation Program - Designed for Depth



...Powering the Design for Depth

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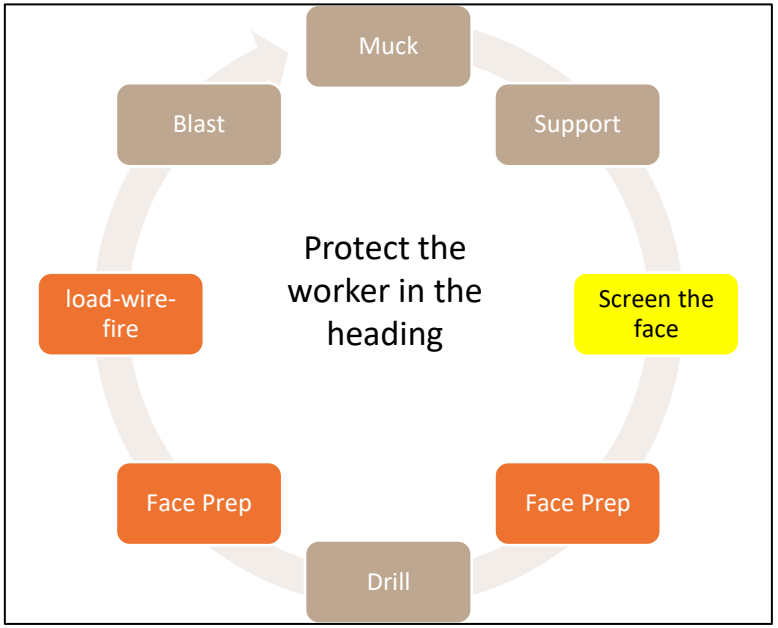
The Progression of Development Mining

The mining industry continues to work to make development mining safer…

Manual Drilling, Bolting, Loading & Blasting

Mechanization and Automation

Standard cycle has not changed



…what is the right next step?

How did we get to where we are?

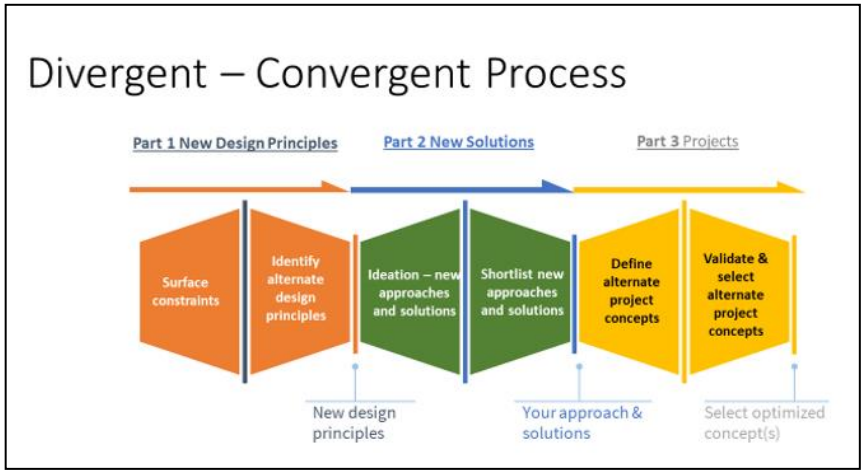
We want to continuously improve safety…

The theory:

1. **Identify the Paradigms**
2. Establish conflicts that cannot be resolved
3. Reframe the problem
4. Explore ideas to resolve the problem
5. Map the new way forward

Paradigms/Mindsets/Ways of thinking

- Keep us grounded and allow us to work efficiently
- Allow us to filter for changes (we like and don't like)
- Guide all of our actions



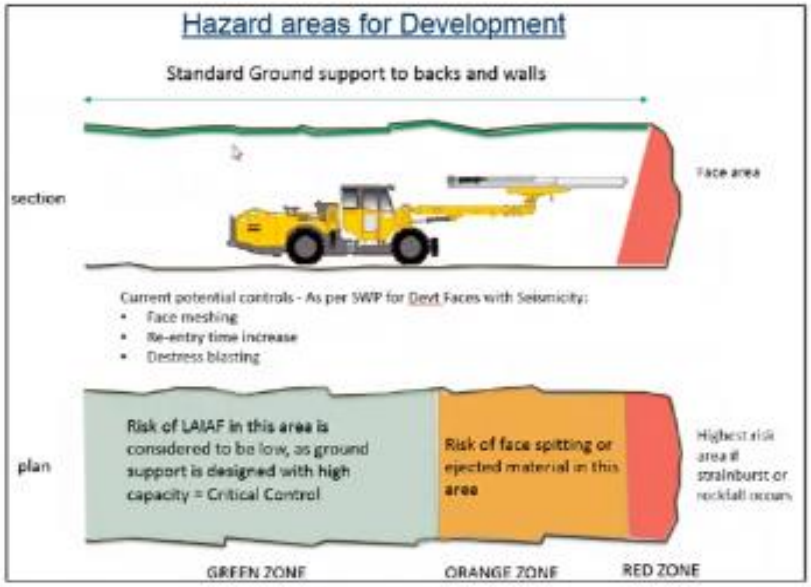
Paradigms/Mindsets

- **Protect the person in the workplace – working at the face**
- **People do the work**
- **Continuous improvement will solve the problem**
- **Our problems are unique, only we can solve them**
- **We buy it from an OEM**

… but we need people to go to the face

High Exposure

We have redefined the problem …

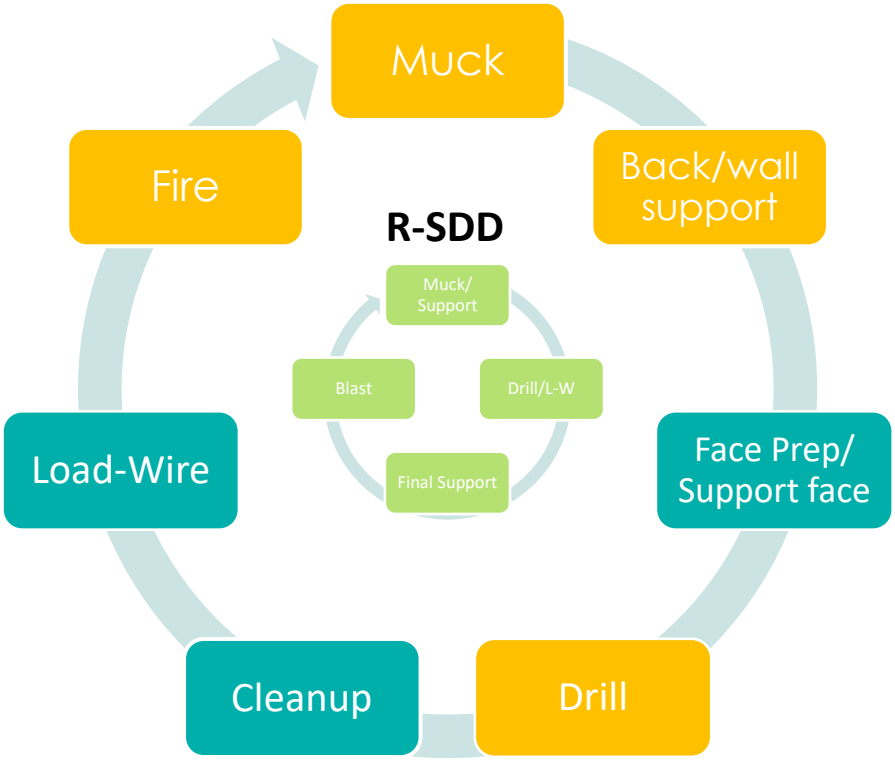


- **By design – have we been trying to protect people from the orange and red zone 100% of the time?**

- **Our mission has been to protect the worker at the face not remove the worker from the hazard.**

… we are now looking for a light bulb

Safe Deep Development



SDD Objective

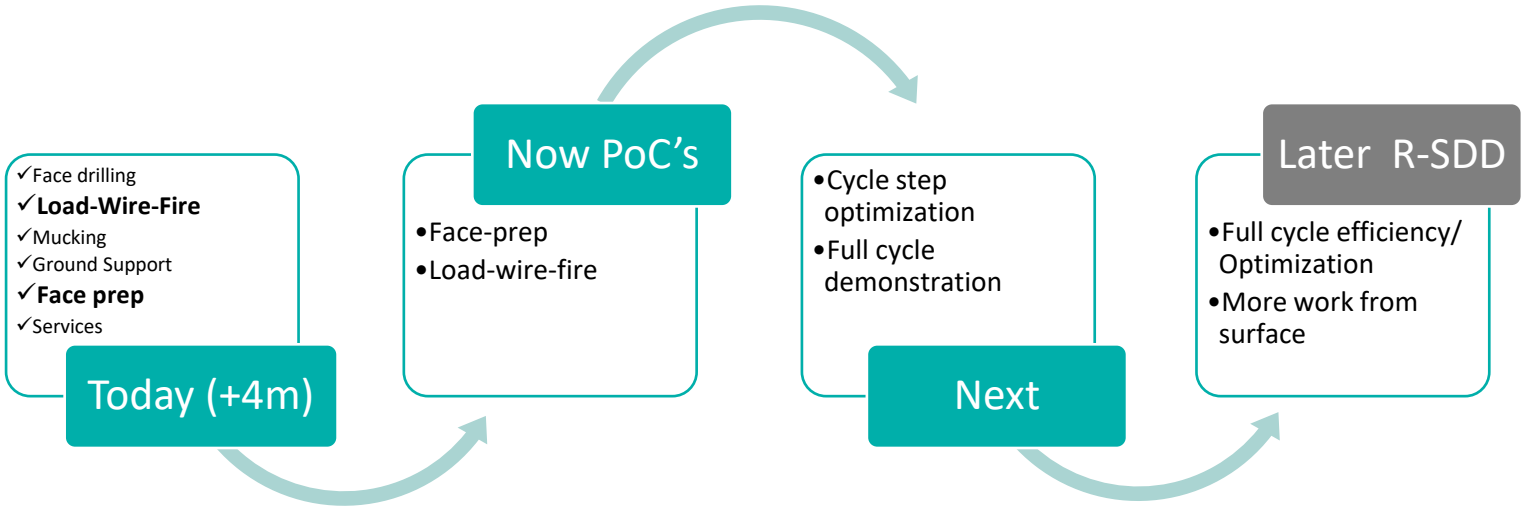
1. No people working with 4m of the active face

Rapid Safe Deep Development

Aspirational

- Improve productivity
- Increase advance rates
- Do more parallel activities (i.e. ground support)
- Reduce in-cycle steps
- Do more work from surface
- More automation is better

Getting 4m from the Development Face



Use the Glencore innovation Design Principles

Follow the proven cycle sequence

Focus on the simplest way to be 4m's back

Proven tech that is not elegant, is still a solution.

Discover technology

- Cycle step optimization
- Reduce "in-cycle" steps
- Focus on the bottleneck
- Do more parallel activities
- Always increase face utilization

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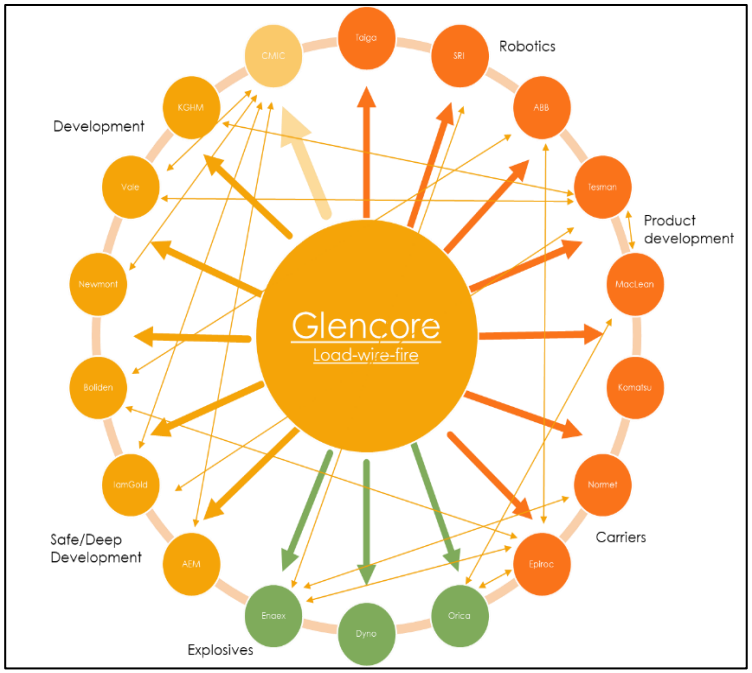
Building an Ecosystem to Support Execution

Collaboration as a core principle for SDD technology development…



Glencore's Safe Deep Development Program

1. **Big picture** – Do more work from surface
2. **Purpose** – All work to be completed 4m back from the face
3. Develop new technology development model
4. Encourage as many prototypes as possible
5. Collaboration is a core principle

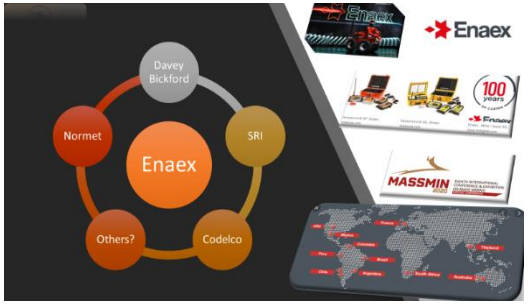
…to continue to improve safety and drive productivity

Avatel – Epiroc and Orica

TESMAN: Remote Face Loading Machine

Safe Deep Development Emerging Technology at Glencore

Orica and Epiroc's advanced technologies integrated into the Avatel™ system.



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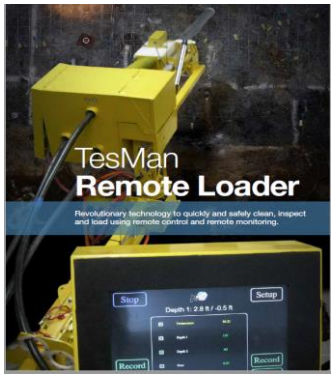
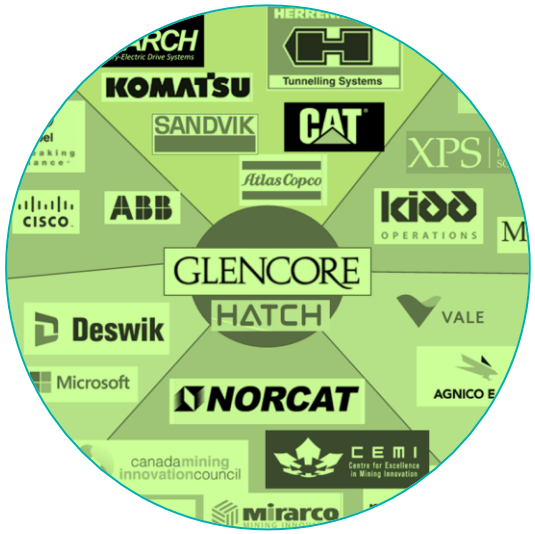


Powering the Design for Depth



Safer – Greener – Efficient – Sustainable – Faster to 1st Ore

Questions?

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