

May 9, 2019

Recent Experience in Mine Innovation at Hecla Mining Company



Presentation to

27th Annual Mine Design,
Operations & Closure Conference
Montana Tech

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Outline for Today

Primary topics for Mine Innovation discussion



NYSE:HL

- Hecla: Our Mines and Key Challenges
- The Approach
- The Technologies and Some Results
- Closeout: Some Advice

Portions of this PowerPoint file were originally presented at CIM 2019 Convention-Montreal on April 30, 2019.

Clarification of Focus

Today's discussion is time-limited

Mining



Underground



Recent / Ongoing



A large, dark, textured background, possibly representing a rock surface or a mine interior, with the title text centered in white.

Our Mines and Key Challenges

Hecla Mining Company

Precious metal producer in North America: where we are



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Hecla Mining Company

Corporate basic information



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2018 Production	
Silver	10.4 Moz
Gold	262 koz
Zinc	56 ktons
Lead	20 ktons

- Founded in 1891; oldest NYSE-listed precious metals producer in North America
- Largest primary silver producer in the USA
- About 1,700 employees total across all operations
- 6 producing mines at present

The Mines

Some characteristics / challenges

- Across the underground mines, ore output varies: <500 – 2,300 tpd
- Mining methods include cut and fill (overhand and underhand), longhole stoping including longitudinal retreat stoping (avoca version) and transverse longhole stoping – all are development-intensive methods
- Backfill operations as part of the cycle
- Relatively small mining fleet sizes
- Small variations within a shift can create large gaps in performance vs target

The Mines

Questions to start the search for solutions

- How can we move our miners farther away from hazards of the working face during the mining process?
- What means may be out there to help keep the mining cycle advancing through shift-end and shift-start?
- How can we know where our team members and mining equipment are located throughout the shift?
- What types of additional efficiencies can new technology bring to our operations?

Innovative Technology

What can bring value to our mines?



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The Approach

Shaking Hands with the Future

So many possibilities...

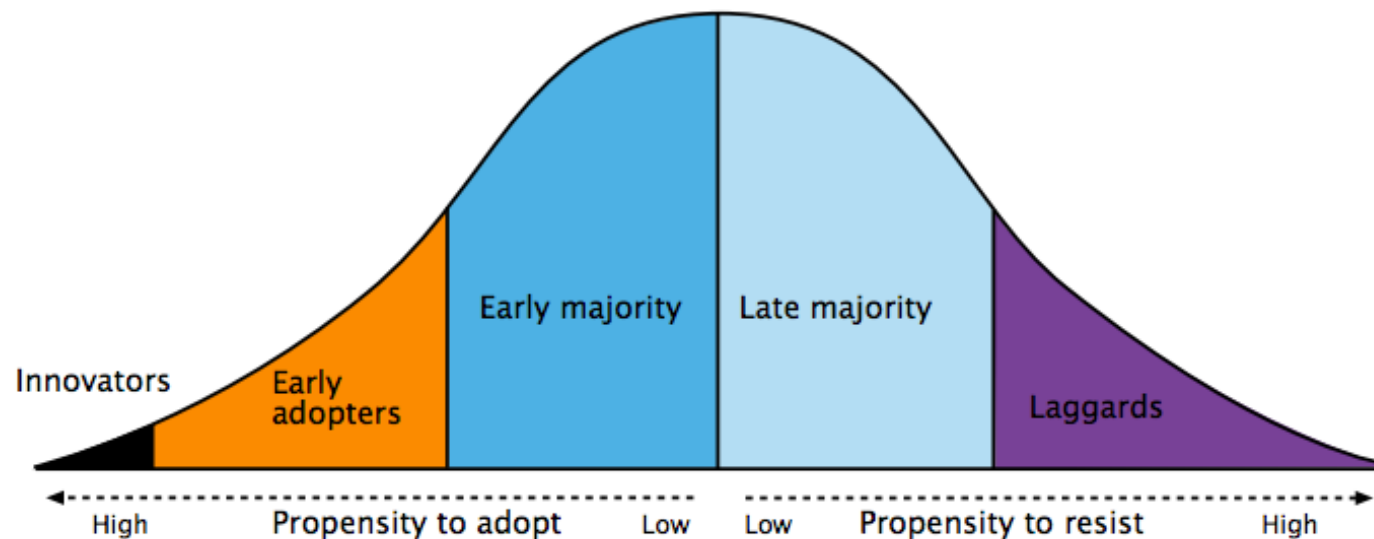


Looking for Solutions

Basic steps

Hecla's effort started in 2014

- Identify and understand the mine's opportunities
 - Constraints and bottlenecks: remove, relocate
 - "Start with the nail; then, find the right **hammer**"
- Stay current with technology advances



Looking for Solutions

See for yourself



- Go see what your industry peers are trying:
 - “What is working for them? Could it help us?”
 - “What do we need to have in place for it to work?”
- Each Hecla mine matched its primary opportunities with potential solutions and created a technology plan as a path forward

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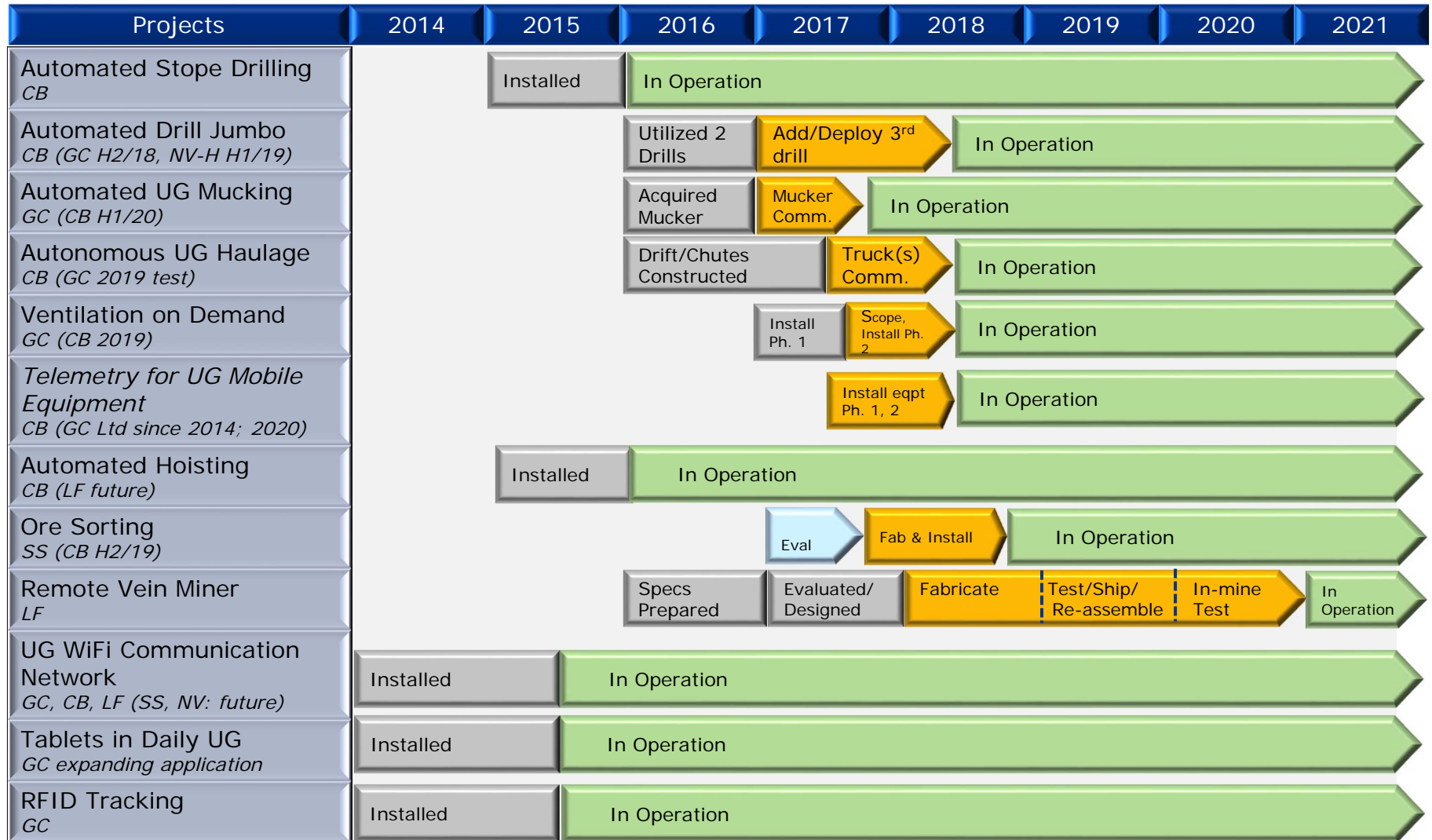
What can bring value to our mines?



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The Technologies... and Some Results

Innovating Across the Mines



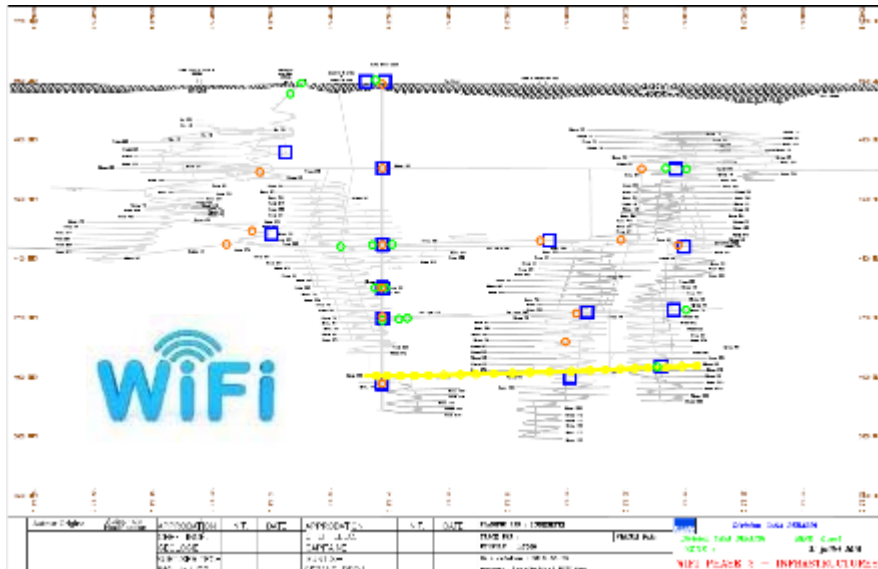
Executed
 In Process
 Operational
 Evaluating

Underground WiFi Communication Network

All mines – in place, in progress, or in planning

Improvement focus is increasing safety and improving productivity by expanding communication capability for voice and data, including ability to remotely control systems and equipment

- Increasingly robust hardware allows for expansion of network edges closer to working faces
- Widespread systems are prerequisite / foundational to application of some additional systems, including personnel and equipment locating and tracking, automation systems of various degrees, and digital device communication



Underground WiFi Communication Network

All mines – for evaluation



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Introducing **HECLAN**

Easily deployable industrialized networking

Hardware combination developed in-house from “best of breed” components as recommended by industry peers and some internal experience

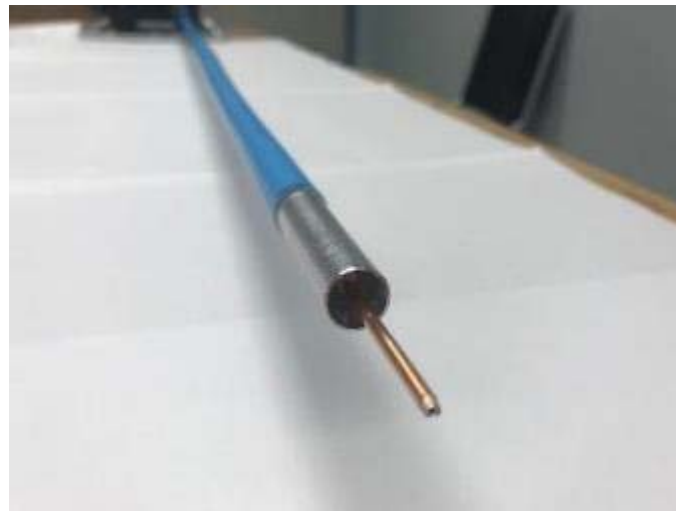


Underground WiFi Communication Network

All mines – in place, in progress, or in planning

Multiple options offered in marketplace with future products bringing more durability, features, and ease of installation and support

- Ethernet backbone options: fiber optic, shielded coaxial, unshielded coaxial
- Wireless access points: fixed, “suitcase” mobile hardware
- The best system is the one that works and which your team can most effectively install, maintain, and expand



RFID Tracking Including Personnel Locations

Greens Creek

Improvement focus is providing real-time tracking of personnel and equipment throughout the mine for safety and efficiency gains

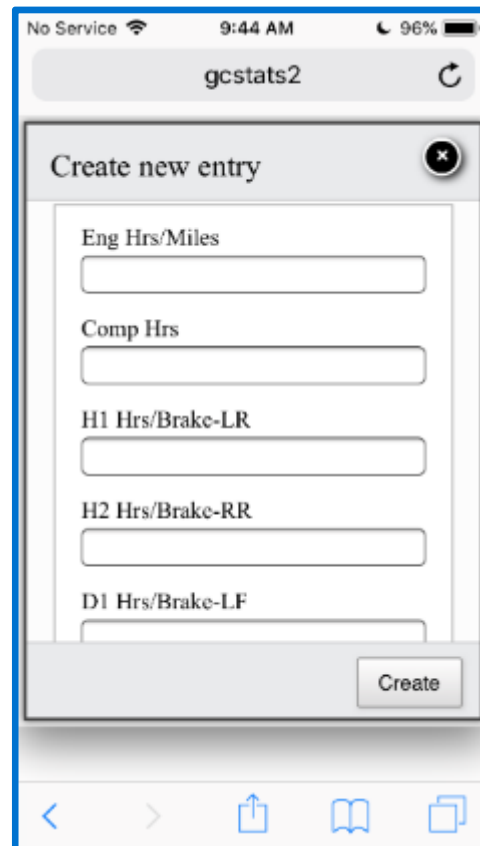
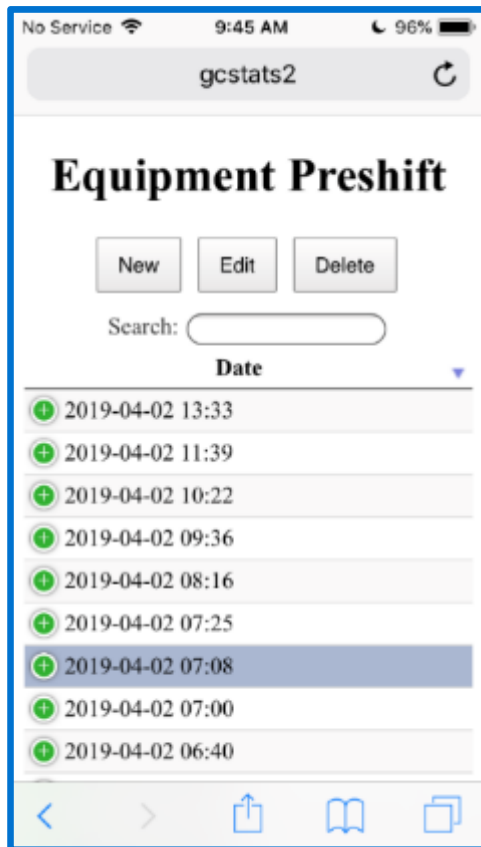
- A foundational technology that allows systems such as ventilation on demand and equipment telemetry to perform their roles
- Though foundational itself, it relies on widespread WiFi or similar communications backbone to be effective



Digital Devices to Replace Paper

Greens Creek

Improvement focus is making data recording easier throughout the workplace, adding instant accessibility to records, eliminating redundant data entry and handwriting issues, providing data for improved decision-making, and reducing work delays and their costs



Automated Drill Jumbo

Casa Berardi; tested at Greens Creek; now at Hollister

Improvement focus is increasing the development advance rate (ft/day) starting with drilling phase

- 'Drill targeting' is a more precise description; drill round design is stored

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Some Results:

These jumbos bring the capability to use longer drill steels (example: 14 ft vs 12 ft) providing a key benefit per round. Experience has shown overbreak examples of dropping from ~12% overbreak down to 9% or even as low as 5%. Underbreak has been seen to be reduced into ~2% range.



Automated Underground Mucking

Greens Creek

Improvement focus is utilizing scheduled hours that had been unused, mainly at start and end of shift

- Sandvik AutoMine Multi-Lite Remote (requires pre-mapping of routes) and Tele-Remote (enables operators to control machines from a distance)
- Remote operation of machines by a person
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Some Results:

Multi-Lite Remote: Bulk tonnage concept is proven. System can be effective when available and utilized.

Tele-Remote: Capable of keeping cycle advancing in shift-end periods. More suitable in assisting in mucking development faces and cut and fill stopes. 2019's daily target is 200 t contributed by this technology.



Autonomous Underground Haulage

Casa Berardi

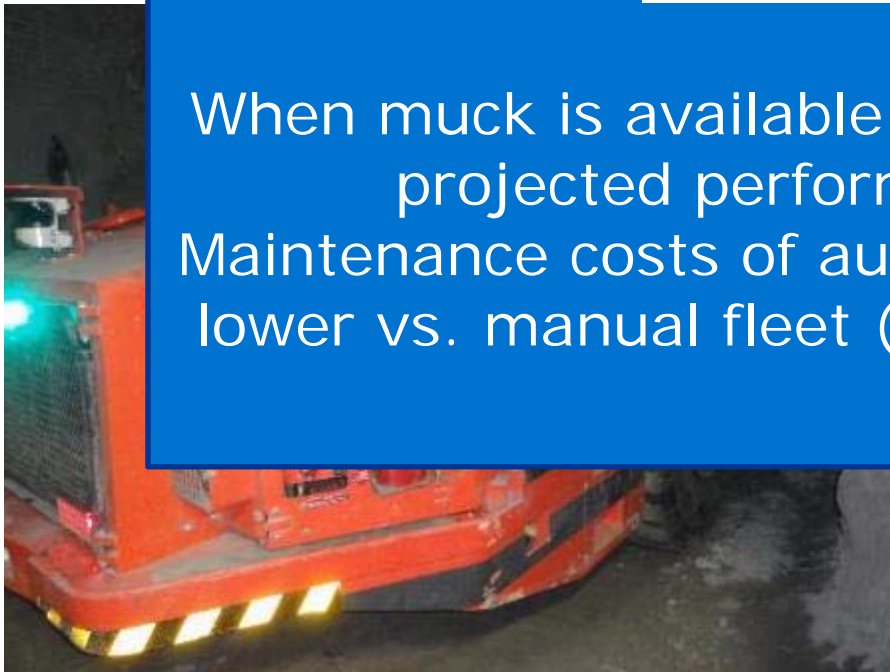
Improvement focus is removal of operators from a workplace and its hazards, and labor and its associated costs, from a routine role that can be performed by automation

- Safety
- Fuel
- Downtime

Some Results:

When muck is available, actual production exceeds projected performance by over 40%.

Maintenance costs of autonomous trucks are ~20% lower vs. manual fleet (includes fleet age benefit).



Telemetry for Underground Mobile Equipment

Casa Berardi – one machine remaining to equip

Improvement focus is cost reduction from improved operator accountability and improved availability from more accurate tracking of machine health

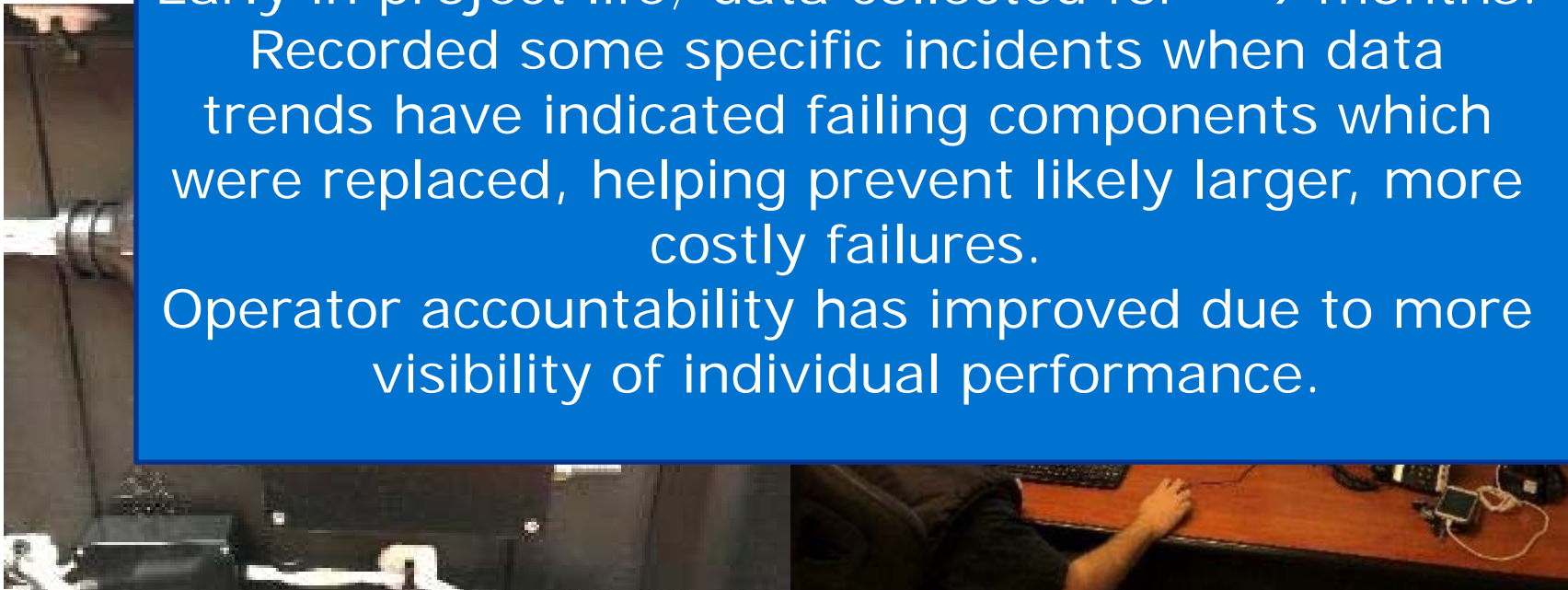
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Some Results:

Early in project life; data collected for ~ 9 months.

Recorded some specific incidents when data trends have indicated failing components which were replaced, helping prevent likely larger, more costly failures.

Operator accountability has improved due to more visibility of individual performance.



Ventilation on Demand

Greens Creek; Casa Berardi (initial phase)

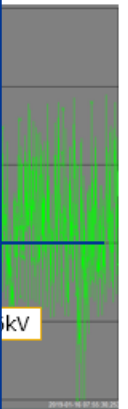
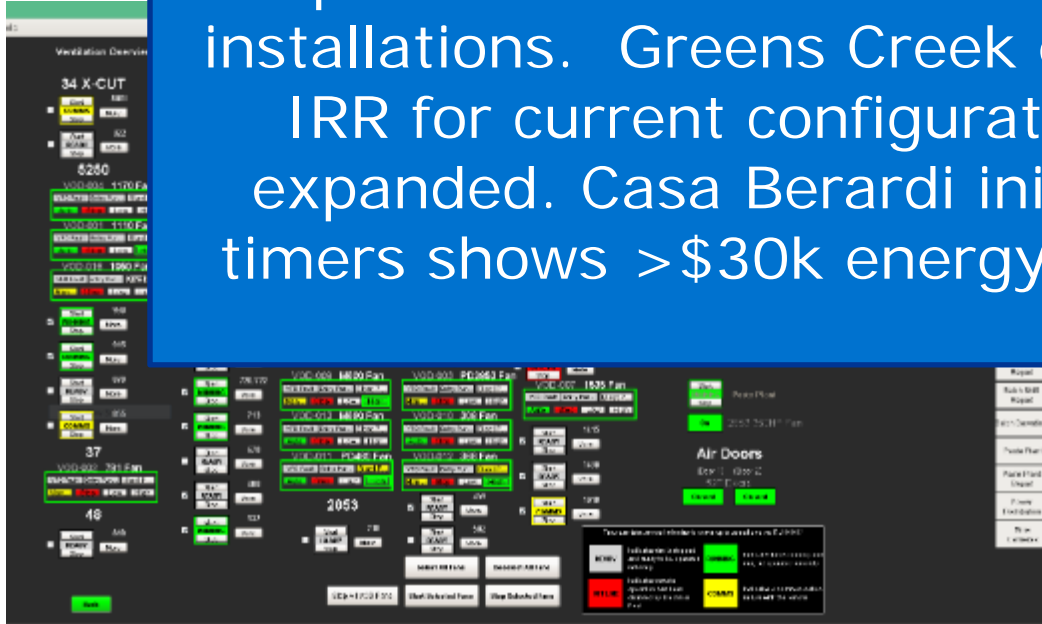
Improvement focus is cost reduction from lowered power consumption

- System turns off ventilation locally when the mine heading is sensed to be vacant

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Some Results:

Scope has evolved based on learnings since initial installations. Greens Creek effort indicates >60% IRR for current configuration -- which will be expanded. Casa Berardi initial phase deploying timers shows >\$30k energy cost savings/month.



Ore Sorting

San Sebastian

Improvement focus is increasing ore feed grade so that maximum metal can be recovered from a smaller volume of processed tons, reducing overall costs

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Some Results:

Plant was built as a 'proof of concept' facility but has already added value via sorting ore and in testing many types of ore and sub-grade. Its optimization is continuing; with adequate feed, it can sort at 20 t/hr for 2 shifts/day. A second sorter was purchased and will go to Casa Berardi in 2019.



Remote Vein Miner

Lucky Friday - machine assembly in Q2 2019 for testing start

Improvement focus is improving safety by moving miners farther away from the hazards of the working face and by eliminating blasting

- New product design developed via a collaborative, risk-sharing partnership between Hecla and Epiroc to create a game-changing approach to narrow vein mining
- Product acceptance testing in Sweden planned into Q4 2019
- One machine to be delivered to Lucky Friday initially with UG testing starting in 2020; a second unit could follow at a date TBD



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What can bring value to our mines?



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**Closeout:
Some Advice**

Learning Needs to Come From All Experience

Takeaways from the journey so far



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- Be able to **learn fast**
- Take advantage of manufacturer's specific expertise as you develop your own in-house; let the supplier **help you be successful**
- Communicate the coming change to all who will be affected; make the reasons for the change intuitive and show that **its success matters**
- How will you measure success? Get **specific metrics** and their tracking systems into place early
- Understand the concept of the "**automation chain**" from the start of the technology adoption process

Learning Needs to Come From All Experience

Takeaways from the journey so far



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- Be aware of and understand the **technical debt** that you may take on; find a means to address it as part of the new 'ecosystem' created for the sustained success of the project
- **Partner with the IT team** every step of the way
- Plan the continued **communication network expansion** as just another piece of accomplishing the weekly plan
- If you can, when you automate a piece of mining equipment, **dedicate it** to use within that system
- If you have a choice to either buy a technology system factory-installed on a machine or add it on later... **buy it installed**

Innovative Technology

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Questions?

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Recent Experience in Mine Innovation at Hecla Mining



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Thank you!