Boliden Mine Automation

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Boliden Mines
Boliden
– produces metals for modern life

• Boliden is a leading metals company with a commitment to sustainable development
• The company’s core competence is within the fields of exploration, mining, smelting and metals recycling
• Six mining areas and five smelters
• Balanced metal mix
  – Zinc and copper
  – Precious metals, lead, nickel as by-metals
• Revenues 40 BSEK
• Approx. 5,000 employees
World-class productivity

Source: Wood Mackenzie, 2016. Graph to the right includes open pit and mines with mix open pit-underground
Mine Automation
- The short story

The main goals are to improve
• Productivity and Utilization
• Mine safety

What's the problem?
• The face utilization UG 25%
• In open pit is utilization up to 80%
Improved Productivity

Productivity can be improved on many levels and the first 3 we are familiar with:

1. Improved ways of working
2. Better performance on unit level
3. Optimization on system level

Now we can add a fourth level:

4. The combination of IoT and Big Data
Improved ways of working
- Mine Operation Centre

- MOC is a good example on how more data can be used to improve productivity by transparency.

- Transparency -> better decisions
Better Performance on unit level
- Volvo claims: 50% cost reduction on transports

Transport cost today:
1/3 Labour cost
1/3 Fuel
1/3 Capex etc

50% cost reduction is quite a lot given the fact that the labour cost for the driver is 33% Volvos calculation is based on lower fuel consumption, higher payload with no cabin and less maintenance needed.
Optimization on System level

• Imagine a remotely controlled wheel loader, loading an autonomous truck when the mine is empty due to blasting. A good example on how to improve the utilization on both the machines as well as on the production faces.
IoT and Big Data

- On the right hand side you see a picture of the 3D model the truck creates to navigate in the mine.

- If we combine the laser scanner data from all machines it would be possible to create a “perfect” 3D model.

- It could detect rock fall, failing air tubes, identify failing rock bolts etc. ... a lot of value could be created from data created for another purpose.
The Mine Automation Program is organized in four “Focus Areas”. The Focus Areas share the common responsibility for Mine Safety.
Infrastructure
- Enabling automation

- Communication backbone in the mine
- IP telephony
- Positioning services
- Production IT services
The Hardware
- Main players...

Access points
Switches
WLAN Controllers
WLAN Management systems

WiFi antennas,
(encapsulating access points)

UPS system
(Batteri backup min 4 hours operation)

IP Telephony & Radio
(also used as positioning tag for people)

WLAN tag
(used for positioning mobile machines)
Production Control

- Short term scheduling weeks ahead supported by automated scheduling tools
- Short interval control based on TOC
- Production analysis
- Production apps for real time reporting/status of ongoing activities
- Production apps for information, schedules, statistics, admin accessible for everyone in the mine
Autonomous machines

- Autonomous haulage & Loaders
- Autonomous drills and bolter remotely supervised
- Charging, scaling and shotcrete robotics
- Continuous miners
Maintenance

• Availability and reliability more important when equipment is remote controlled

• Communication infrastructure will enable monitoring equipment health in real-time

• Remote support will improve response time when failures occurs
How to reach the vision?

Our Partners

Our partners are the key to success. When you look at our roadmap, never forget that it is our partners that are doing the bigger part of the investment.
Technological Development and Automation

History

In the Beginning

Hammer & Sledge

Handheld pneumatic hammer, sledge and dynamite

Mechanisation

Mechanisation
Hydraulics
Control systems
Energy

Automation

Automation
LHD
Long hole drills

Communication

Autonomous traffic
Safety
Regulation
Coordination
IoT
Control centre

Today

Coordinated Automation

Future
Communication and Information network

WLAN & Mobilaris & VoIP
- Kristineberg, Renström, Kankberg
- 2017/18 Tara

WLAN & Mobilaris
- Garpenberg (2017 → 100%)
- Garpenberg open stope coverage

Strategical development Ericson
- High precision position
- 5G in Kankberg
Autonomous Machines open Pit

Today
Test Autonuomous Pit Viper

Near future
Autonomous drilling in Aitik and Kevitsa
Remote bench scaling and cleaning
Autonomous stockpile loaders
Autonomous haulage truck
Autonomous Machines Underground

Today
Autonomous LHD (Garpenberg Mine, Tara Mines)
Simba, Video remote (Garpenberg Mine, Tara Mines)

Near future
Autonomous haul trucks underground
Autonomous battery LHD with autonomous charging
Video-remote controlled autonomous tunnel drills, bolters
Continuous miners

Future
Autonomous combo drill & charge and scale & shotcrete units
Short distance remote operated scalers & shotcrete units
Thank you!