Agnico Eagle Kittilä Mine

Strategic Optimization Projects

Jari Näsi
Development Manager

AGNICO EAGLE
FINLAND

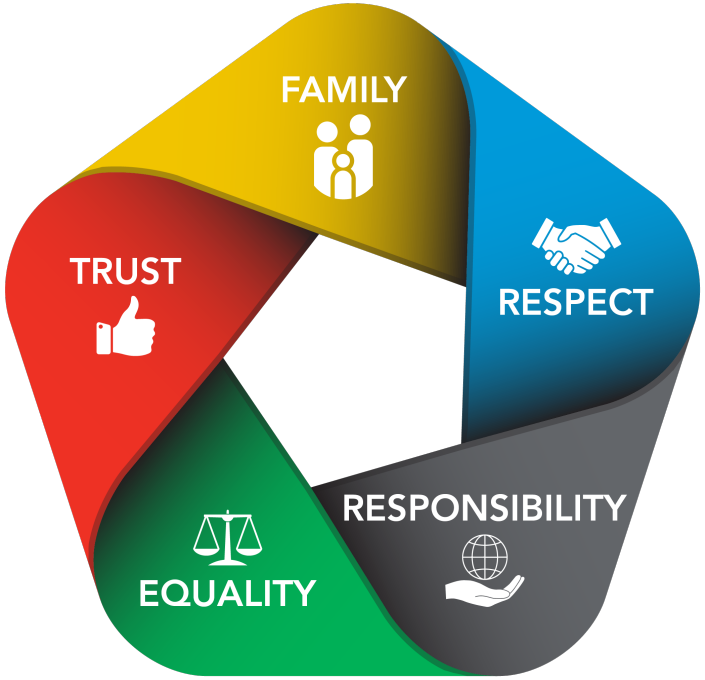
Our Mission

Agnico Eagle's mission is to build a high quality, easy to understand business – one that generates superior long-term returns for our shareholders, creates a great place to work for our employees, and contributes positively to the communities in which we operate.

Our Values

At Agnico Eagle, we are defined by our core values of family, trust, respect, responsibility and equality.

These values express who we are and guide us in everything we do. They are the link to our history, central to our culture and an essential element of our success.




Kittilä Mine

The Largest Gold Mine in Europe

First signs of gold spotted in Kiistala in 1986. The 1st gold bar was poured in 2009.

The estimated mine life till mid-2030s.

Gold reserves 3.8 million ounces. Approx. 7,500 kg of gold per year.

Ore processing capacity 2 million tonnes/year.

Number of Agnico employees 500; number of contractors' employees 600.

Of Agnico employees over 50 % from Kittilä and over 90 % from Lapland.

Turnover € 351 million in 2021.

Socio-Economic Contributions in 2021

1100 employees

Ca. 500 Agnico employees and 600 contractors

€44 million

Salaries paid to Agnico employees

€10 million

income taxes paid by our employees

€220 million

Purchases from Finland

€1,3 million

Compensations to landowners

€390,000

Support to schools, non-profit organizations, sports and culture

€5.9 million

Royalties paid to the state

€450,000

Real estate tax paid

€18 million

Corporation tax paid

Investing in the future

€250 million expansion and infrastructure investment program on-going at the Kittilä mine

- Building a 1,044 meter deep shaft
- Processing plant capacity raised to 2.0 million tonnes per year
- New service level at -900 meter
- Tailings ponds and other infrastructure investments

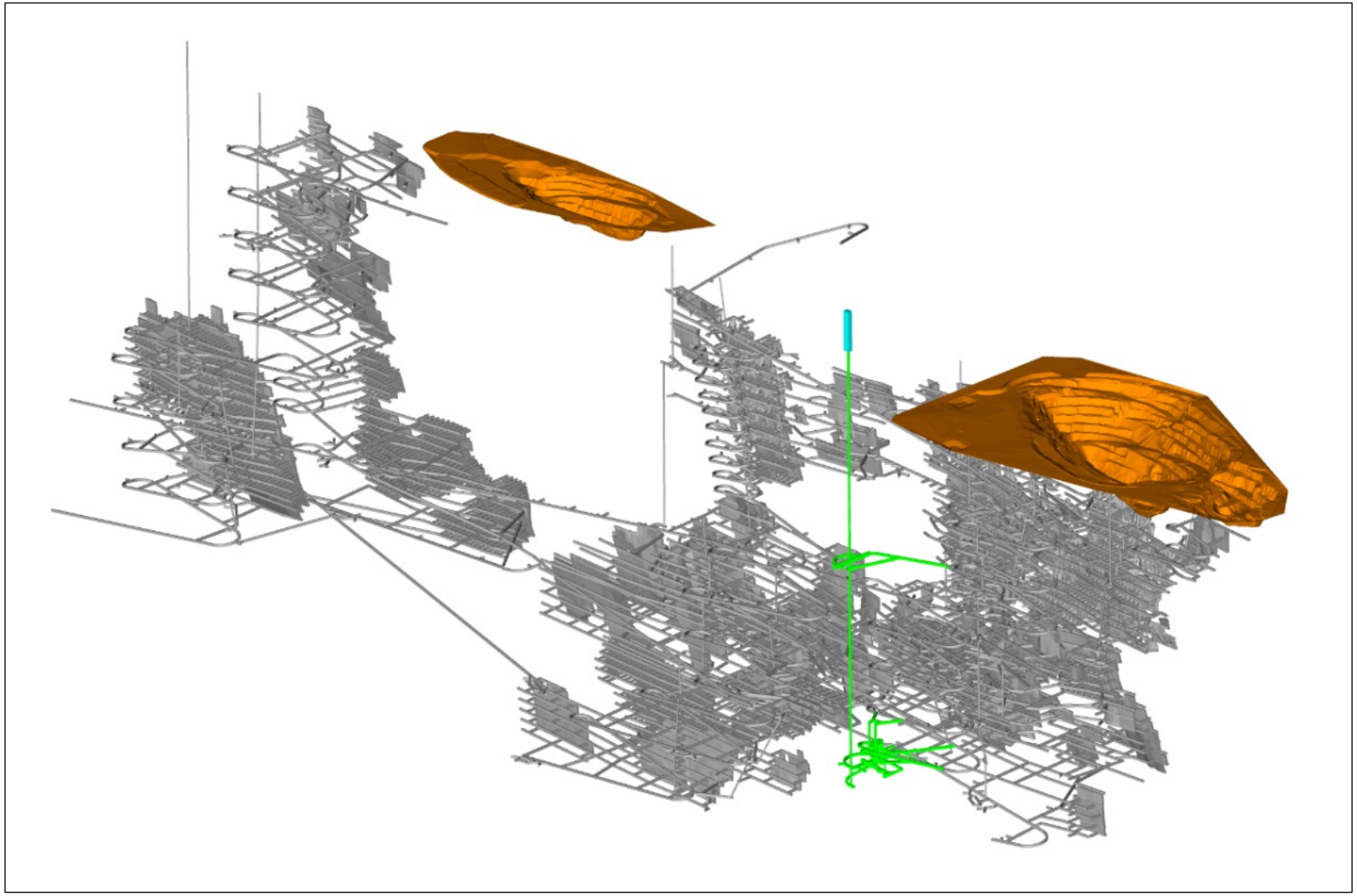
Active exploration and business development in Finland and other Nordic Countries

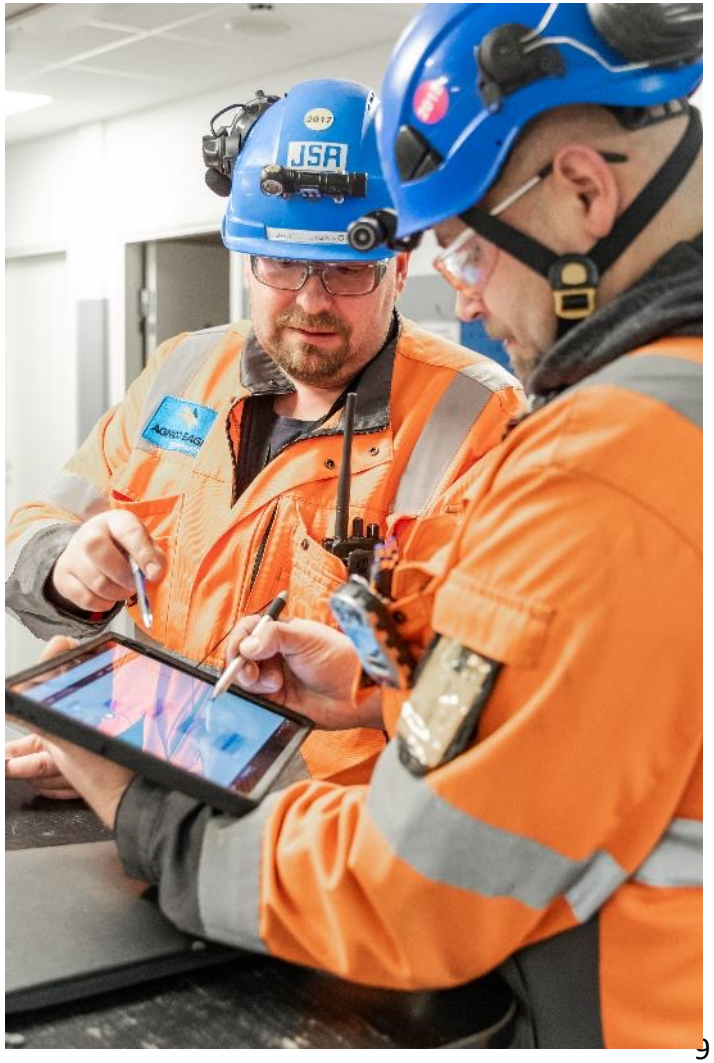
Investing in Technology and Innovations

Partnering with universities and equipment manufacturers to develop next generation technologies for the future mines

- Decarbonization and electric fleet
- Advanced automation and autonomous mining
- Advanced water treatment technology
- Energy efficiency

Underground Mine





Underground Production

Cable bolting

Raise boring

Drilling

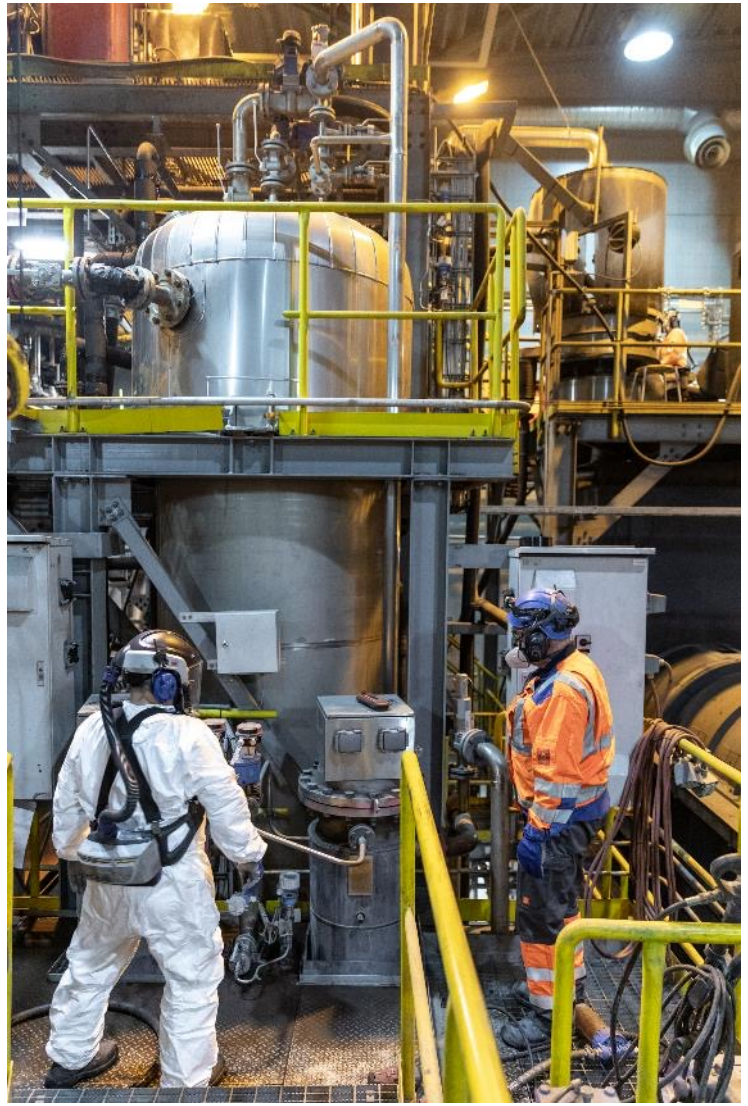
Charging

Blasting

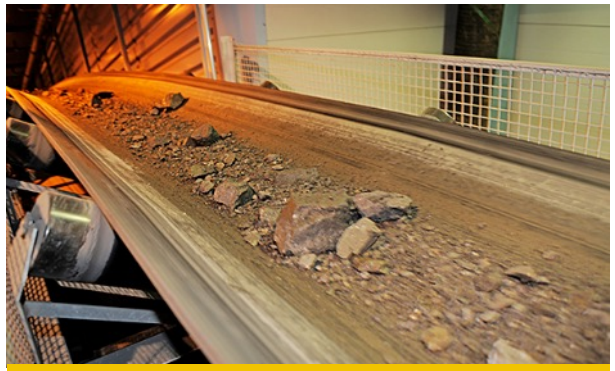
Loading & hauling

Back filling

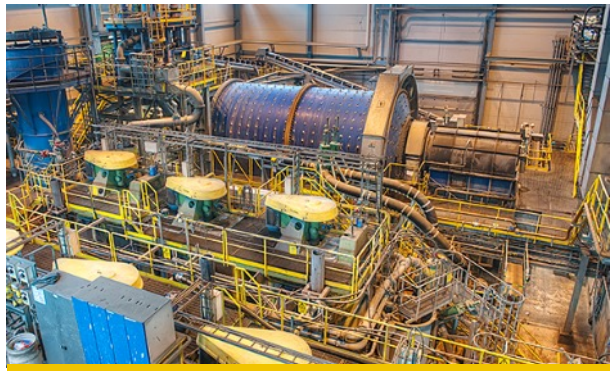
Mineral Processing



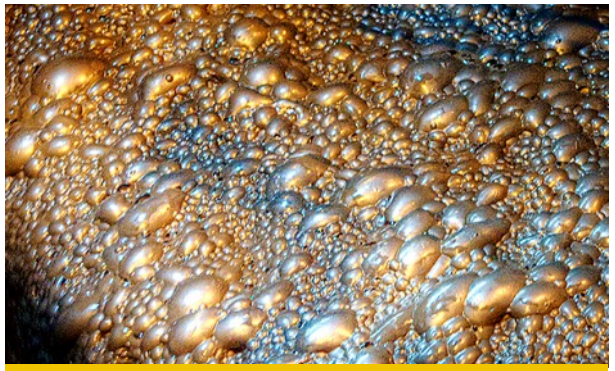
The Largest Gold Mine in Europe operates in Kittilä



Crushing



Grinding



Flotation

Pressure oxidation

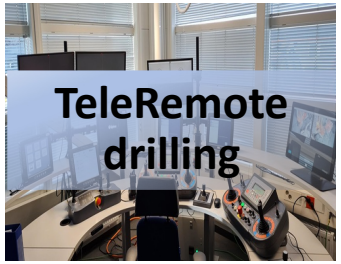
Leaching

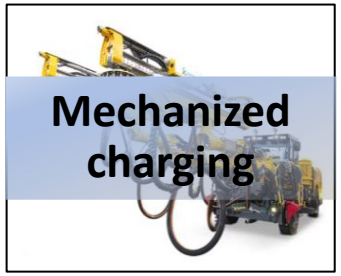
Electrowinning

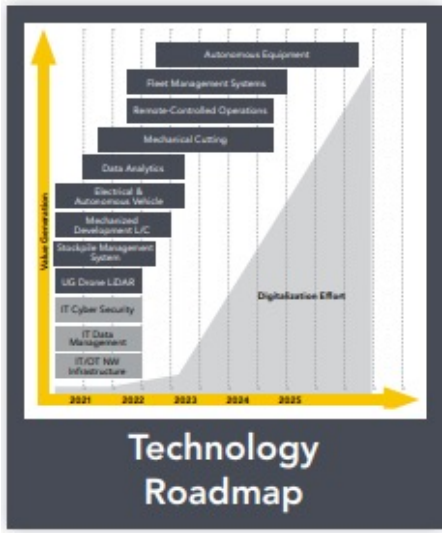
Strategic Optimization Projects
Agnico Eagle Kittilä Mine Department

AGNICO EAGLE

We have identified several technologies which can help Agnico Eagle Kittilä to be the mine of tomorrow.

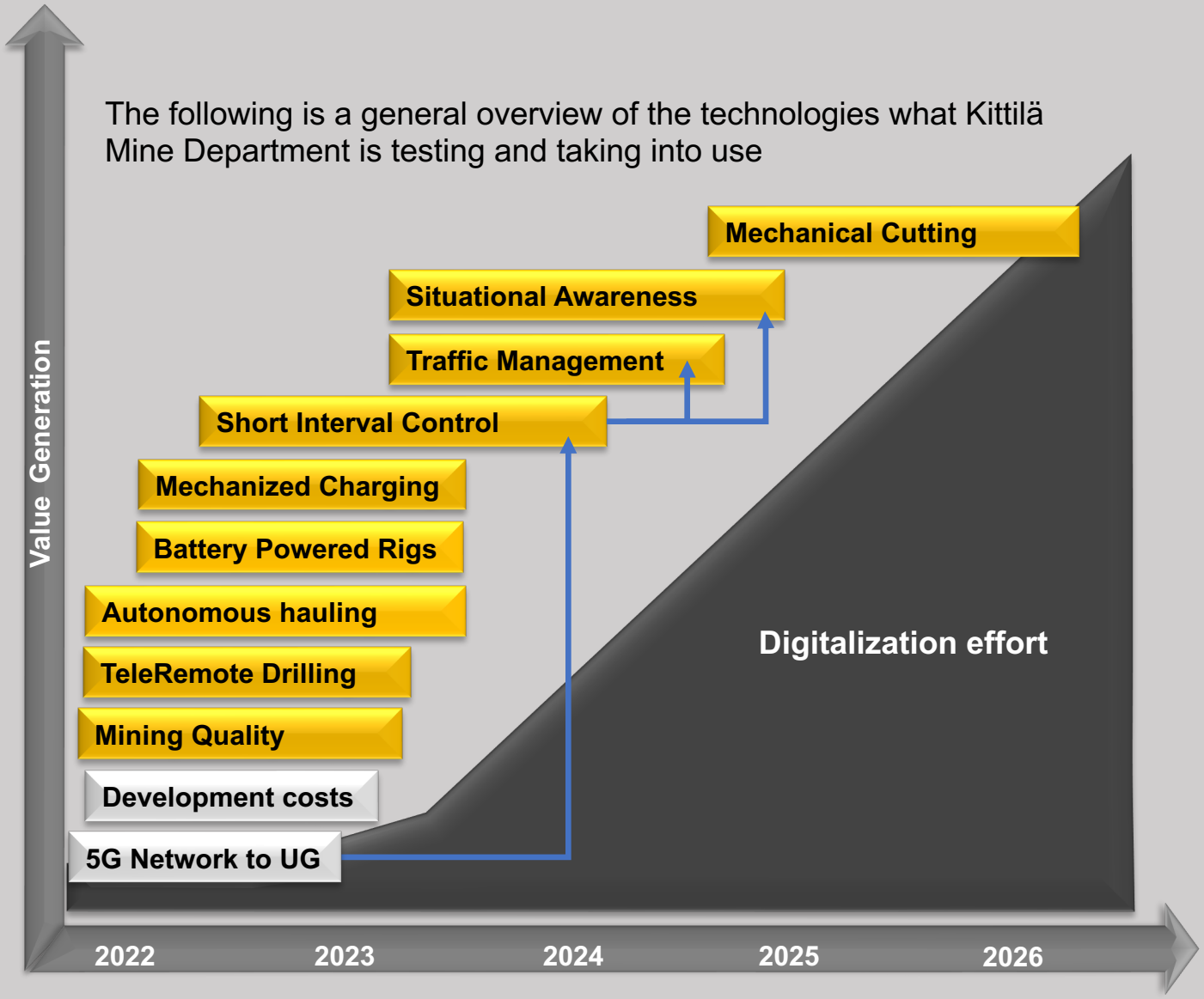






STRATEGIC OPTIMIZATION

The following is a general overview of the technologies what Kittilä Mine Department is testing and taking into use



TRLs – TECHNOLOGY READINESS LEVELS

Technology Readiness Levels (TRLs) are a method for understanding the technical maturity of a technology during its acquisition phase.

5G Network

Quick facts

Service owner	Jan Nakolinna
Objectives	Deliver and support a cost-effective wireless telecommunication platform to the business needs.
Means	Build an unified bespoke private 5G AS network covering the whole mine site; both underground and above ground. Consolidating multiple ill fit legacy wireless solutions with one.

10 month build of a very large brand-new network. Consisting of 104 radio units and covering >10km^2 aboveground and >140km underground; covering all active production areas.

Allowing unrestrained AutoMine, autonomous and TeleRemote operations anywhere onsite.

Production go-live end of October 2022.

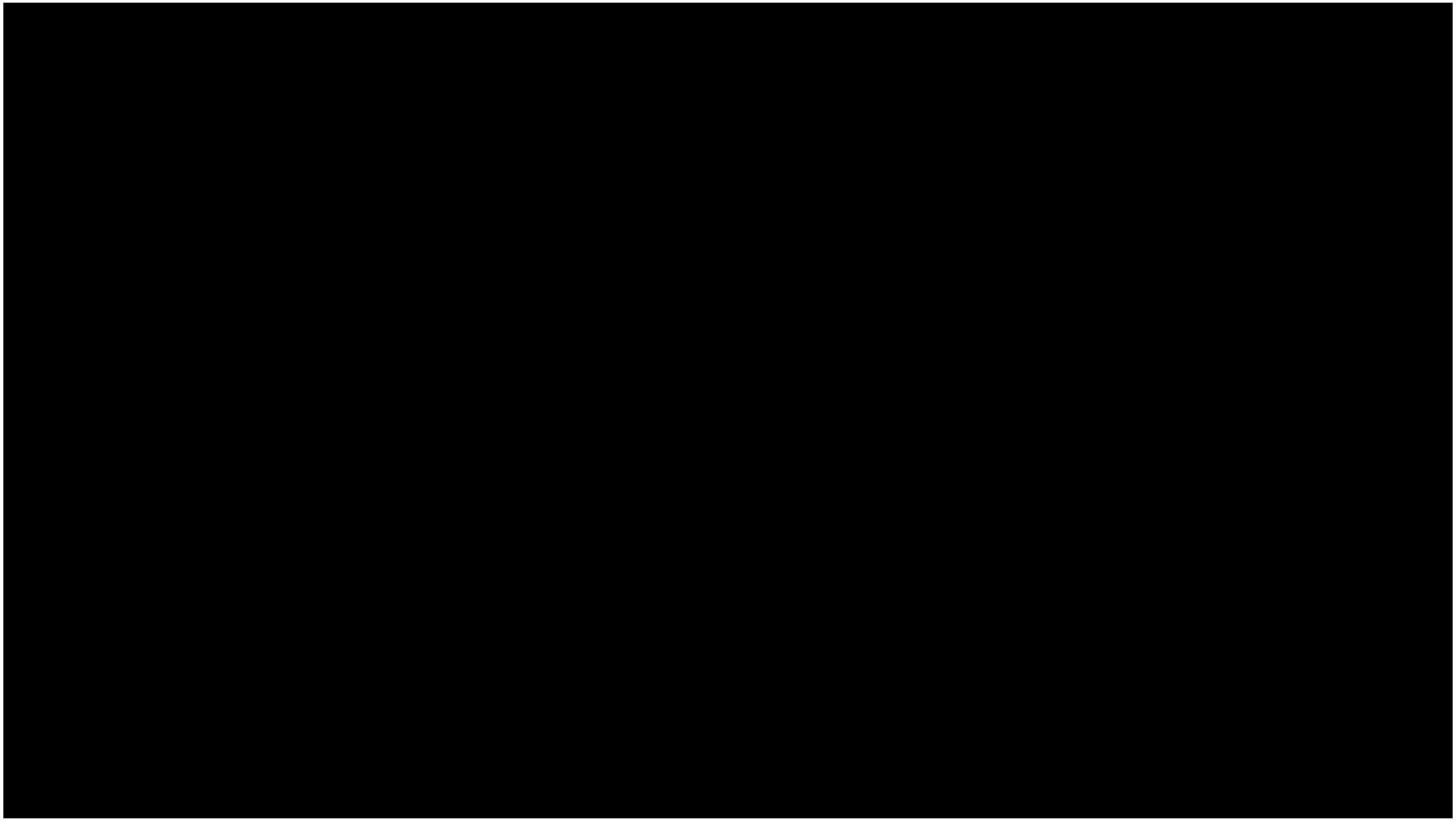
AGNICO EAGLE FINLAND

NOKIA

Telia DIGITA

TRL 9

5G Network



Development Costs

Quick facts

Team leader	Matias Suomela
Objectives	Ramp up annual development to 18km/year level and decrease unit price (€/meter).
Means	Improve Overall Equipment Effectiveness of equipment, personnel, and headings and optimize processes by mine visualization, near-real-time-reporting, improved collaboration with control room.

TeleRemote development drilling with 4 machines. Increase utilization instead of increasing Jumbo fleet from 5 to 6 rigs.

Cable bolting efficiency ramp up from 52m to +100m/shift instead of increasing fleet from 3 to 4 machines.

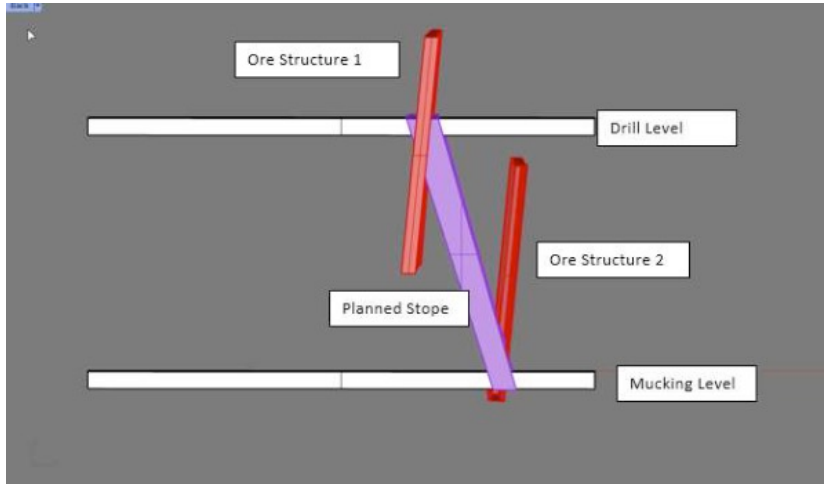
TRL 9

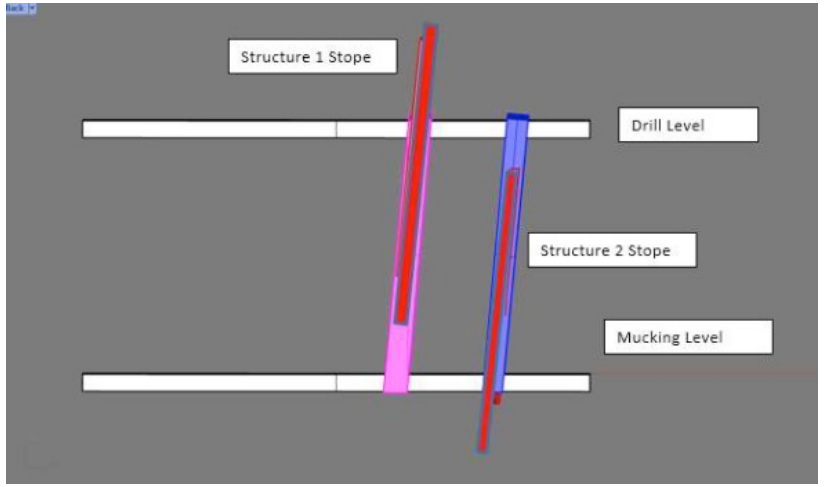
Mining Quality

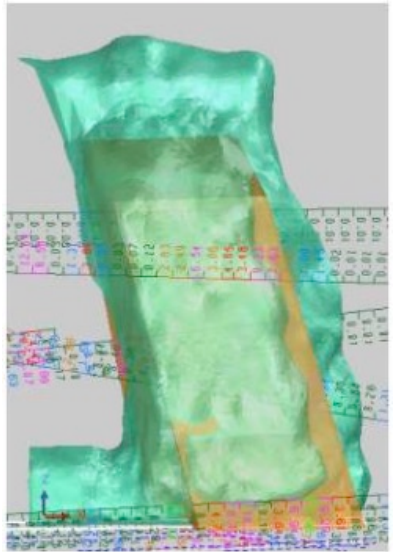
Quick facts

Team leader	Jari Näsi
Objectives	Detailed mapping and better structural understanding Dilution control
Means	In the fringe of the orebody, the lack of interpretation has led to mining stopes that had a higher than expected internal dilution. Drilling patterns, charging and blasting practices will be optimized.

Interpretation of the fringe ore or complex zones must be improved in order to ensure that the mining block is in ore. **Photogrammetry is used to systematically** mapp stuctures in development headings.
In order to increase the predictability of the ounce production, it is important that the present strategy to mine to maintain tonnes will be changed to one that includes the ounce delivery.







TRL 9

TeleRemote Drilling

Quick facts

Team leader	Tapani Kemppainen
Objectives	Increase use of TeleRemote drilling to 85% level in production drilling.
Means	**Operate four production drill rigs by two operators**, one in control room and second at underground doing piping, transfers and drill bit changes.

Production drill rigs and TRB Raise Boring unit has been equipped with TeleRemote drilling functions and is operated over WLAN/5G- networks.
The implementation of remote operation room to operate several drill rigs is a key project part to operate automated and autonomous machines.

TRL 9

Autonomous Hauling

Quick facts

Team leader	Tapani Kemppainen
Objectives	Improve health and safety as well as the productivity and production capacity of operations. Decrease ore/waste trucking costs by increasing truck utilization and ton km/shift rate.
Means	Replace conventional trucks by autonomous mine trucks. Load trucks by TeleRemote loaders directly from ore/waste passes. Take advantage of the available hours between shifts to continue the operation.

Sandvik TH663i truck has been trialed at Kittilä Rimpi area since 9/2020. Target is to achieve 3000 tkm/shift production rates. One truck has been hauling ore from level 750 to surface.

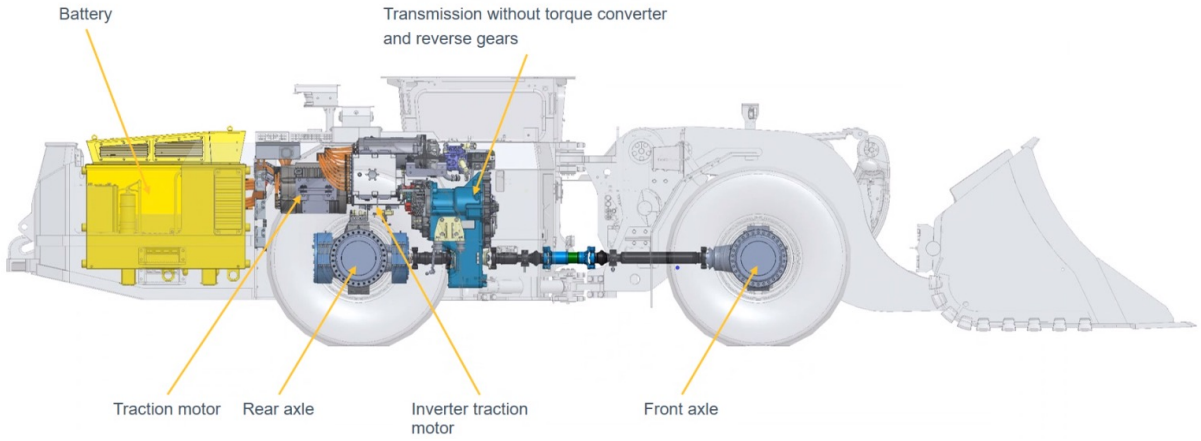
TRL 8

Battery Powered Rigs

Quick facts

Team leader	Matias Suomela
Objectives	Improve air quality in underground areas as well as to maintain or improve productivity and production capacity.
Means	Use electrical vehicles where possible to lower ventilation requirements and lower maintenance cost.

Battery powered drill rigs and LHD’s can be fitted to remote controlled or autonomous fleet easily as they are already controlled electrically.
Mine design and infrastructure must be adapted to take advantage of these technologies by designing sufficient power supplies and battery change stations.



TRL 8

Mechanized Development Charging - Avatel

Quick facts

Team leader	Jari Näsi
Objectives	Reduce operator time and exposure to tunnel faces to decrease risks to rock mechanical hazards. Improve miners safety at high stress conditions.
Means	Mechanize the development charge-up activity and remove personnel from development face. Orica and Epiroc have developed charge-up vehicle and wireless (WebGen) detonators. Charge-up process will be done from a protective vehicle cabin.

Avatel unit will be tested in Kittilä operations at IV/2022 to validate charging effectiveness and usability in varying rock conditions. Moreover, automated charging technology with accurate electronic detonators will improve productivity and blast quality.

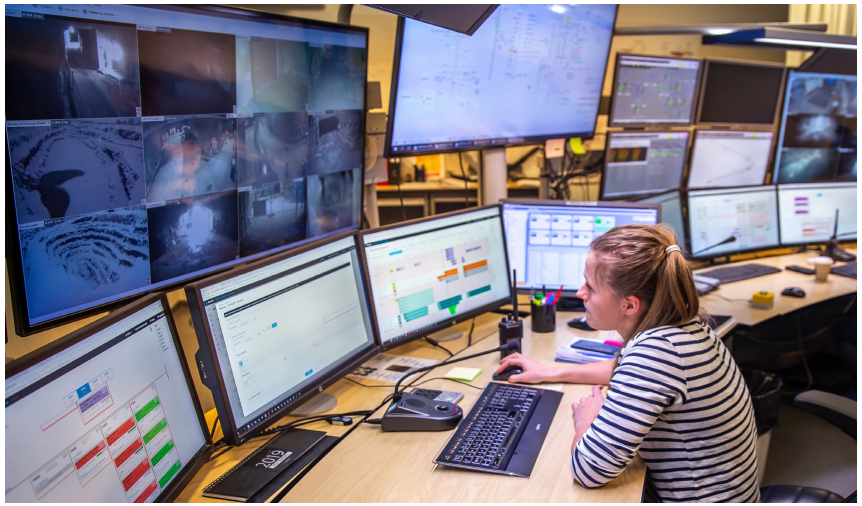
TRL 7

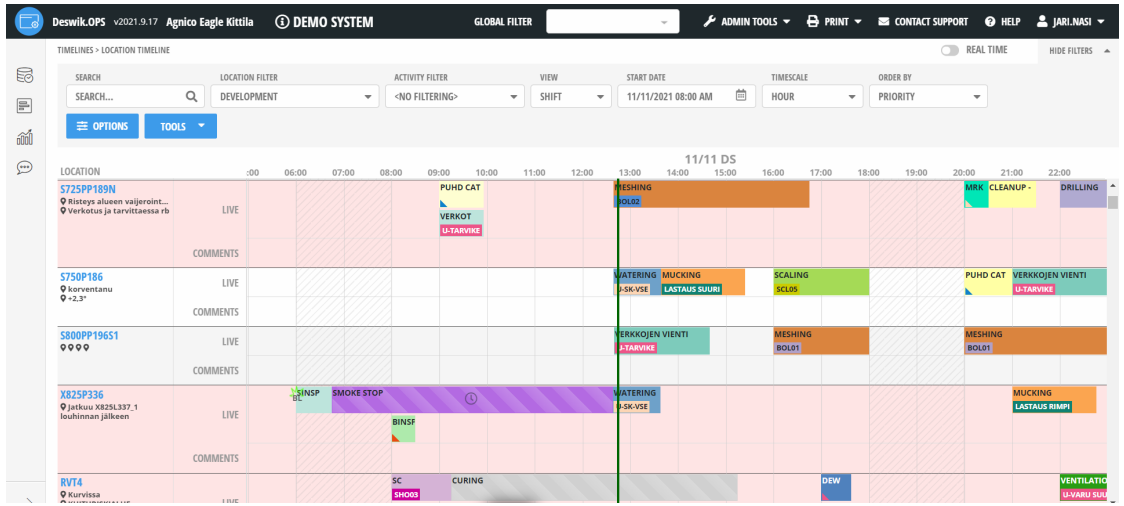
Short Interval Control

Quick facts

Team leader	Toni Arpi
Objectives	Data collection from operators (Near Real Time reporting) Tasks start up, finalization and possible delays. Travel times and actual working hours.
Means	Continuously updating task list to operators. Control Room engineers can take into account delays/roadblocks and change task prioritization during the shift. Operators will use tablet apps to report task start up's, delays, readiness and consumption.

Systems in test and development phase: Strategy planning ongoing, target to fully implement 2023. Deswik OPS has been selected to strategic partner.





TRL 7

Mine Digitalization

Quick facts

Team leader	Jani Ollikainen
Objectives	Start to use **mine visualization, tablet reporting & traffic control** to increase productivity, centralize data-driven decision making and create synergies.
Means	Tablet reporting by operators, shift bosses and maintenance. Traffic management & tunnel layout with underground ”Google maps”. Exact location to each vehicle which has visualization tablet and tag/connection to 5G network.

Currently in specification & strategic partner selection face: Smart phone & tablet (Deswik), positioning and traffic control over 5G network (Sandvik).

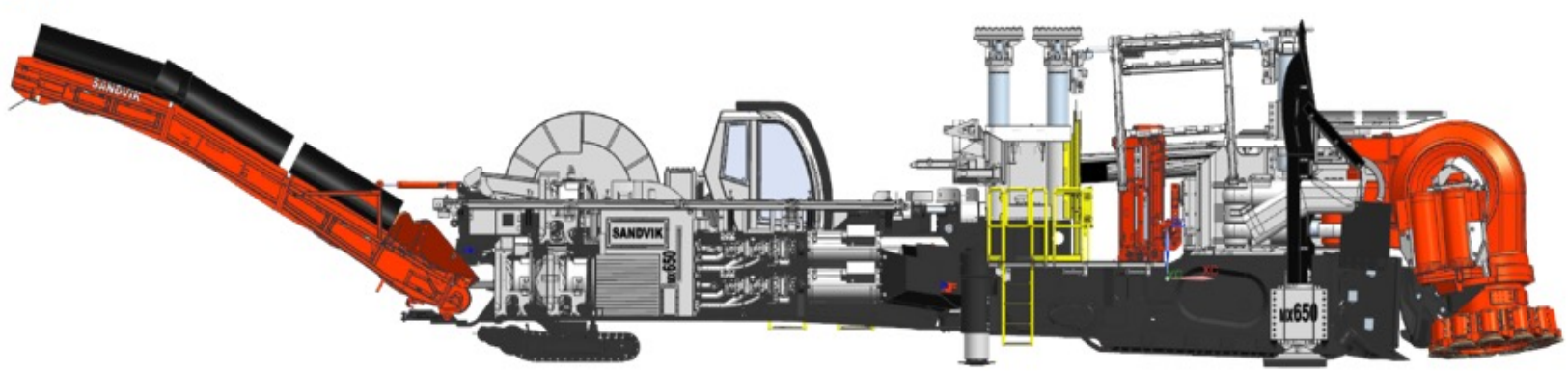
TRL 7

Mechanical Cutting

Quick facts

Team leader	Jari Näsi
Objectives	Change the traditional drill and blast mining methodology by introducing continuous mechanical cutting equipment. Improve development rates and optimize tunnel profiles.
Means	Use continuous mining machine to cut and support tunnel with higher development rates.

With the Sandvik MX650, we are evaluating whether we can replace drill, blast & muck conventional mining sequence. These equipment has significant benefits as: continuous mining, decrease worker's exposure to dangerous locations, better tunnel profile, etc. The current challenge is to prove the economic viability of these equipment when rock strength and abrasivity are above 150 MPa.



TRL 6

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Thank you!

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