Remote Longwall Mining

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Komatsu Mining – The Integration of Two Mining Machinery Giants

… Komatsu is leveraging the best of both businesses.

‘Dantotsu’ = unrivalled
… to become indispensable to our customers, working as one team to provide the mining industry with Dantotsu Products, Dantotsu Service and Dantotsu solutions.
Longwall Mining Today

Most Australian longwalls as a minimum aim for an automated shear maingate to tailgate

- “Teach” the shearer the profile from tailgate to maingate.
- Allow shearer automation to repeat the profile from maingate to tailgate
- Roof supports lower, advance, set, push and operate flippers automatically, interlocked to the shearer position
- Many manual activities done on the face that have little or no electronic monitoring, e.g. creep management, in seam direction control, cleaning the bretby tray, watching for broken shear pins, management of cavities, blockages, etc

The technology exists today for remote control and mines are testing the waters

- Metropolitan utilized Joy remote PRS and shearer technologies alongside automation to operate through an outburst risk zone in LW27 and LW301.
- Appin mined through their “boggy” zone using Joy automation and remote technologies in LW707
- Grosvenor has completed a shear from the surface

Remote mining has been a short term success but…

- It hasn’t been the preferred operation method in normal conditions
- Too many exceptions that require manual intervention
- Poor or non-existent visibility of all the variables from which operators make decisions
Automation is the Key to Remote Mining - Some Present Enablers to Autonomy

Longwall Technology available today

3D Face mapping
- LASC automated face straightening
- 3D laser scanning
- Face horizon can be mapped and altered

Personnel Proximity Detection System
- Operator safety around moving equipment
- Policing hazardous zones (dust etc)
- Increased automation could mean less operator familiarity with risks (less coal-face time)
- Extra layer of protection for on face maintenance, inspection or mining condition exception intervention

3D Geometric Control and Visualisation
- Anti-collision between equipment
- Enables remote operation and supplements camera systems
- Better training aids
Some Present Enablers to Autonomy (cont.)

VSD Control of Armoured Face Conveyors
- 40% Increase in AFC life
- Reduced AFC Maintenance Downtime
- 20% Increase in AFC Drive Efficiency
- Reduced capacity electrical reticulation system

Longwall Shearer Pitch Steering
- Reduced stress and wear
- Minimizes power demand
- Improves pan control
- Increases the recovery rate
- Reduces material reject rate
- Reduces the need for manual intervention
- Operators moved away from the machine
- Automation method that applies to the floor drum
- Maintains a configured pitch angle of the pans
- Roof steering method via Shearer remote or manual entry of the pitch corrections via the RS20s Mimic or planning tool
- The nominal pitch profile is based on surveys / geological data

Pitch Steering
Advanced Shearer Automation
Full Remote Management – Continuing the Journey to Autonomous Operation

The current technology roadmap for Longwall mining is to provide the enablers to move operators from the coal face and to manage the operation by exception from a remote location. To do this we need to utilize proven automated control systems and further build on these as emergent technology becomes available to the industry.

Vision:
- System runs in full automation
- People only on the face to conduct maintenance, statutory inspections and handle mining exceptions
- To provide sensors on the longwall to achieve full automation and provide information to the Remote Management Centre (RMC)
- For skilled operators at the RMC to be able to observe operations and make necessary corrections

Limitations of Vision:
- Current ability to provide all the sensors required for full autonomy – some gaps exist especially around in-seam mapping at the required resolutions
Remote Management and Smart Solutions – The Building Blocks

Remote Management Interface
- Secure solution to allow management of the machines
- Initiate high level actions to a machine (Control roof supports, Start Shearer, commence automation, etc)

Smart Solutions in Realtime
- Perform analysis of the data in Realtime
- Utilize IOT technology
- Manage and deploy analytics from the Cloud
- Provide the information to the appropriate person or control in Realtime
- Web based Visualization Apps

Longwall Visualization
- Camera images & real-time sensor information
- Visualization of Data real-time/historical

Core Control System
- Shearer
- PRS
- AFC
- Auxiliary (Pumps, Switch Gear, etc)

Longwall Planning
- Provide tools to plan the operation of the Longwall
- Open architecture to core solutions
- Integrate mine survey data
- Provide interfaces to the systems
- Mines can create custom enhancement
In Summary

- Remote mining is currently achievable but with many limitations that prevent it from being utilized under all conditions.
- Komatsu currently has crucial automation features and products to enable a transition to remote management and is working to create the building blocks for further progress.
- Our vision for remote management is that people will only be on the face to manage mining exceptions, perform statutory inspections and conduct maintenance.
- The remote management solution requires advanced analytics to understand the multitude of data that currently flows from the thousands of sensors available today and to identify the gaps in technology.
- Collaboration and partnership will accelerate the extraction of true value from the data.
- The ‘self-driving car’ of Longwall systems can (and will) become a reality but there are still social and technological challenges to overcome.