



Real Mining. Real People. Real Difference.

Longwall Automation: Ambition Across the Years and the Hemispheres

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&

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LONGWALL USA 2015 Pittsburgh, PA





In the beginning...There was R.O.L.F

R.O.L.F: Remotely Operated Longwall Face

- Proof of concept in 1959
- UK National Coal Board attempt to "Realize the Dream" of Longwall Automation
- Media reports technology triumph
- Royal commissioning ceremony

ROLF was unsuccessful due to availability and maturity of technology





55+ years later... We are yet to "Realize the Dream"

Technology improved, but individual focused development resulted:

- Powered Roof Support (PRS) electronic controls
- Shearer technology
 - Data communication on power cable
 - Automated cutting and tramming
- Armored Face Conveyor (AFC) control
 - Motor load sharing
 - Chain tension management

Safety, productivity and cost have improved, but fully automated face is still a vision





A new field offers insight: Process Control Engineering

It sounds difficult ...But Its not:

- Generate a detailed PROCESS MAP (Example Bi-Directional Cutting)
- Do a GAP ANALYSIS ... What can be done versus need to be done
- Make a plan of how to "Fill the Gaps" (Technology or Policy)
- Development of "Known" solutions
- Research tasks where reliable solution are not available
- Implement solutions based on Cost/Benefit, Complexity and Risk
- Evaluate performance
- Continue efforts until success is achieved

The best solutions are simple and reliable



LONGWALL MINE OF THE FUTURE AUTOMATION JOURNEY PLAN

Moranbah North









2014 **UNI-DI** Operation **Simple Automation**

UNI-DI Cutting FaceBoss ASA & RS20s Face alignment 850mm web depth Smart Services







Smart Services 850 web depth **BI-DI Cutting Integrated Automation** Automated Face Straightening Collision avoidant configuration

5 Operators on the Face **Face Operation**



2016 Remote Monitoring and **Advanced Automation**

Smart Services BI-DI from ROC 1000mm web depth Improved Face illumination Improved Dust Control Shearer & Area cameras High Speed Digital Communications

2 Operators on the Face plus MG personnel for

Remote Monitoring and Operation from MG roadway





2017 **Remote Operation with Fully Automated System**

Smart Services AFC/BSL VFD Control or 11kV? Enhanced cameras

2018

Remote Supervision Semi Autonomous Operation

Smart Services **Spatial Awareness** Seam Positioning **Remote Mining**

100%

167%

Grosvenor)

ROM Coal (MNM &

0 Operators on the Face Remote Operation and Supervision from MG roadway

June 2015: Longwall USA



Focused on safety, Reducing risk

Impact of 103 Safety Items Identified **Grosvenor Peer Review Process**



Original 1750t MNM Equipment Matrix Rating



- Grosvenor Equipment Matrix Rating
- Grosvenor Equipment Operated via ROC Matrix Rating

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Partnership Journey: Remote Operation Center







What is Longwall Automation?

Definition of Automation:

• Equipment repetitively performing consistent sequences of required tasks without human intervention.

The Vision





Autonomous Operation



Remote Operation



Longwall Mine Of The Future Journey Plan

Benchmark Performance with Drive to Zero Harm







Migration to Remote Operation – Journey Plan

Phases	1: Face Operation	2: Face Monitoring	3: Remote Monitoring	4: Remote Operation
Face Operation	5	3	2	0
Remote Operation	1	1	2	2
Controls & Automation	Base Automation	Advanced product automation and features	Integrated system with Remote Operational Center (ROC) for monitoring	Remote operation from ROC

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Exception Management

Change Management



Migration to Remote Operation – Phase 1 & 2 Highlights

Advanced Shearer Automation – Realize Value

- Fully automate run of face cutting sequences & gate end turnarounds
- Consistent operation cut heights, haulage speeds, cut sequence

Consistent use of Automation improved productivity – up to 12%



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ASA Offline Planning System
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Face Alignment – Optimize Productivity, Reduce Downtime

- Implement automated face alignment
 - Reduce pass to pass cycle times



Rate improvement by utilizing Automated vs Manual face alignment – up to 8%



Migration to Remote Operation – Phase 3 & 4 Highlights

Environmental Awareness – Consistent Automation

- System anti-collision
- Cavity detection
- Coal face visualization





Consistent environmental awareness improved stability & hours – up to 9%

Remote Monitoring – Reduced Exposure

- Individual displays for remote system monitoring & operation
- Fully integrated communication



Minimize exposure: Zero Harm



"Realize the Dream" of Remote Operation is attainable



Migrate to Remote Operation from the ROC





General Discussion Close