Application of Shearer Automation
Introduction

What is the direction of coal mining in Australia?

AUTOMATION AGE

“Coal will be automated. It is inevitable”

Courtesy Australian Longwall Magazine
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Introduction

What has driven longwall automation in Australia to the level it currently is?

Ageing mining population potentially resulting in a shortage of experience

Coal price – Thermal and Choking
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How is the technologies driven to form part of the equipment?

CUSTOMERS PROCURING NEW LONGWALL EQUIPMENT

Each longwall tender has a clear specification which outlines “Standard Specification Minimum Requirements for Longwall Automation”
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Introduction

Aspects of longwall automation:

- Shearer State Based Automation
- Radar detection
- Shield Automation
- Ethernet Communication and EIP interface between equipment
- Operational visibility
- Trending and Event Log
- LASC
Introduction

Aspects of longwall automation:

- Shearer State Based Automation
Shearer behaviour is defined to automate each state of a cutting cycle, irrespective of the cutting method used.
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Introduction
Aspects of longwall automation:

- Shearer State Based Automation
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Introduction
Aspects of longwall automation:

• Shearer State Based Automation

*Drum height indication calculated and referred to the TRUE floor*
Introduction

Aspects of longwall automation:

- **Shearer State Based Automation**
  A parameterized roof and floor profile is defined into sectors to create an extraction zone.

  - *This becomes the reference to steer face horizon* -
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Aspects of longwall automation:

- Radar detection
  Collision avoidance between cutting unit and shield canopies
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Aspects of longwall automation:

• Shield Automation
  By means of comms interfacing, shearer position is used for shield defined sequences which includes gate-ends.
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Aspects of longwall automation:

Ethernet Communication
Fast and reliable communications set the platform for EIP interface, visualization & SCADA tools, trending of operational data & event logging and LASC
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Aspects of longwall automation:

- EIP interface between equipment
Introduction

Aspects of longwall automation:

• Operational visibility
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Aspects of longwall automation:

• Trending and Event Log
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Introduction

Aspects of longwall automation:

• LASC

A system created by CSIRO which provides data of the cut profile, which can be used to maintain horizon control in a longwall panel, as well as face alignment.
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Immediate objectives for automation
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Immediate objectives for automation

To reduce exposure to the risk and elements of longwall mining
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**Immediate objectives for automation**

To maintain consistency in longwall production

Comparison in production at Oaky Creek No. 1 prior to the implementation of ESB and ESB in use.

*Courtesy Oaky Creek No.1 mine 2011*
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Immediate objectives for automation

- OCC #1 Tonnes / Operating Hour (May 2011)
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Immediate objectives for automation

To maintain consistency in longwall production

- OCC #1 Tonnes / Operating Hour (Nov 2011)
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Immediate objectives for automation

To maintain consistency in longwall production

OCC #1 SCA DA TREN DS – Haulage speed reduction vs. Methane

Courtesy Oaky Creek No.1 mine 2011
Immediate objectives for automation

To maintain consistency in longwall production

Approx. 988.02 tonnes/shear ROM
Cutting Dilution 20.54%
Average Cutting Height 2.2m
Average Cut Stone Height 0.17m

Before ESB Implementation

OCC #1 Cutting Dilution

Courtesy Oaky Creek No.1 mine 2011
Immediate objectives for automation

To maintain consistency in longwall production

Approx. 963.32 tonnes/shear, ROM
Cutting Dilution 13.79%
Average Cutting Height 2.21m
Average Cut Stone Height 0.1m

ESB implemented

OCC #1 Cutting Dilution

Courtesy Oaky Creek No.1 mine 2011
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Immediate objectives for automation

To maintain consistency in longwall production

A positive impact has been observed particularly directly after implementation, in the availability of equipment at all mines where automation was implemented.

Reduce equipment downtime and it will positively impact production

Grasstree
Carborough Downs
Integra Mine

Oaky Creek No.1
Oaky North Mine
Tahmoor Colliery
Ulan Coal

Courtesy Carborough Downs 2009
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Requirements for effective automation
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Requirements for effective automation

Redundancy of automation components
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Requirements for effective automation

Redundancy of automation components

- Sensor redundancy

Using different sensors to measure a specific automation hardware, compare the values for accuracy of automation, and to act as a fall-back for component failure and ensuring reliability of ESB.
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**Requirements for effective automation**

Redundancy of automation components

- Via BPLM
- Via WIFI
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Requirements for effective automation

Understanding each site’s method of coal cutting PRIOR to implementation.

Avoid the “cookie mold” mentality.

Understand how automation needs to be applied.
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Requirements for effective automation

Follow solid project practices when implementing automation

1. How the customer explained it
2. How Marketing proposed it
3. How the analyst designed it
4. How the programmer wrote it
5. What the beta testers received
6. How the business consultant described it
7. What operations installed
8. How it performed under load
9. When it was delivered
10. What the customer really wanted
11. The disaster recovery plan
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Requirements for effective automation

Follow solid project practices when implementing automation:

**SAFELY ON TIME, WITHIN BUDGET AND IN SPEC**

- Stay focused on the final outcome from the start.
- Planning should be broken down into stages.
- Set smaller targets in order to meet the COMPLEX one.
- Continuously manage your risk and have contingencies.
- COMMUNICATE, COMMUNICATE AND COMMUNICATE.
- Test in stages: BENCH → INTERFACE → FACTORY → COMMISSION.
- Measure the progress made and capture the details.
- Review the good & bad and set the benchmark for the next.

Carborough Downs
Integra Mine

Grasstree Mine

Oaky Creek No.1
Oaky North Mine
Tahmoor Colliery
Ulan Coal
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Requirements for effective automation

Database applications and analyses to monitor behavior patterns

Changes made to parameters
Trending shearer operational data and events
Event log

Courtesy Tahmoor Colliery 2013
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Requirements for effective automation

Clear visibility of what exactly occurs in the longwall
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Requirements for effective automation

Clear visibility of what exactly occurs in the longwall
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Requirements for effective automation

Clear visibility of what exactly occurs in the longwall

Regular underground representation – Support agreements with the OEM
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Requirements for effective automation

Mind-set for automation – Involvement from management to end-users

- Head-office
- Site Manager
- Production Management
- Production Planning
- Longwall Supervisors
- Engineering Management
- Technical Support
- VISIBILITY

- Carborough Downs
- Integra Mine
- Grasstree
- Oaky Creek No.1
- Oaky North Mine
- Tahmoor Colliery
- Ulan Coal

Longwall crew (Operators & Trades Persons)
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Oaky Creek North
Australian Record Breaker

- Oaky North – 2009 Longwall Panel retreated a total of 4,985m
- Total metres travelled = 4,985m x 250m = 1,246,250m
- The Shearer travelled a total of 12,462 km
- 12hour shift - 29,642 tonnes from the Longwall
- 24 hour - 56,890 tonnes
- Weekly - 312,506 tonnes
- Monthly - 1,146,721 tonnes.
- In 2009 the mine produced 8.1M tonnes ROM (second highest producer)

Was the highest producer of longwall coal in Australia for 2010, 2011 and 2012
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The challenge we currently face!!
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Challenges within automation

A large amount of shearers are installed in longwalls globally
There is a lack in the application of automation referring to the global longwall mining industry.
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Challenges within automation

This has an impact in the growth of longwall technologies when comparing with other mining industries.
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Automated longwall systems AND adequately managing these systems has the potential to play a vital role in safe and consistent production.

By having more longwalls automated, will speed up the progress in advanced technologies and will contribute in the future of this great industry.

Courtesy Oaky Creek No.1 mine 2011
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“Automation makes mining safer”

Eickhoff SL Shearer Series

Highest reliability combined with state-of-the-art automation features makes work at the coal face most productive and safer than ever before.

Even for difficult applications and harsh mining conditions, the most powerful and reliable solutions are available through Eickhoff.

Experience has no substitute – Eickhoff since 1864

Eickhoff

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