

Application of Shearer Automation



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

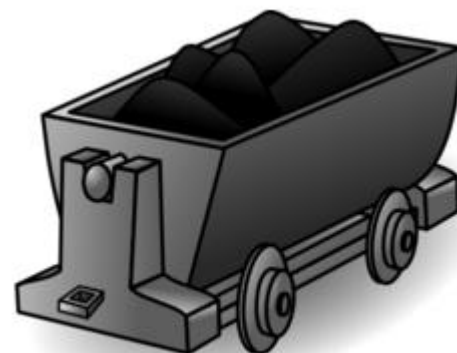
Application of Shearer Automation

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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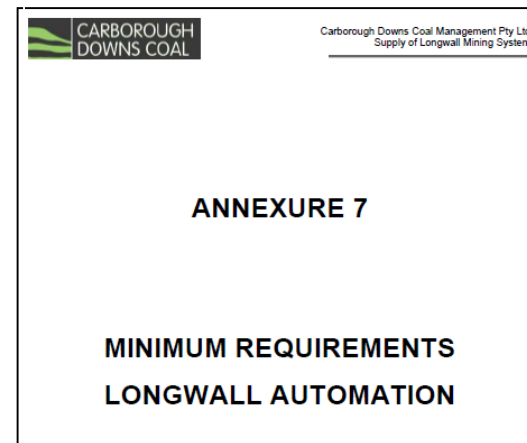
Introduction

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”

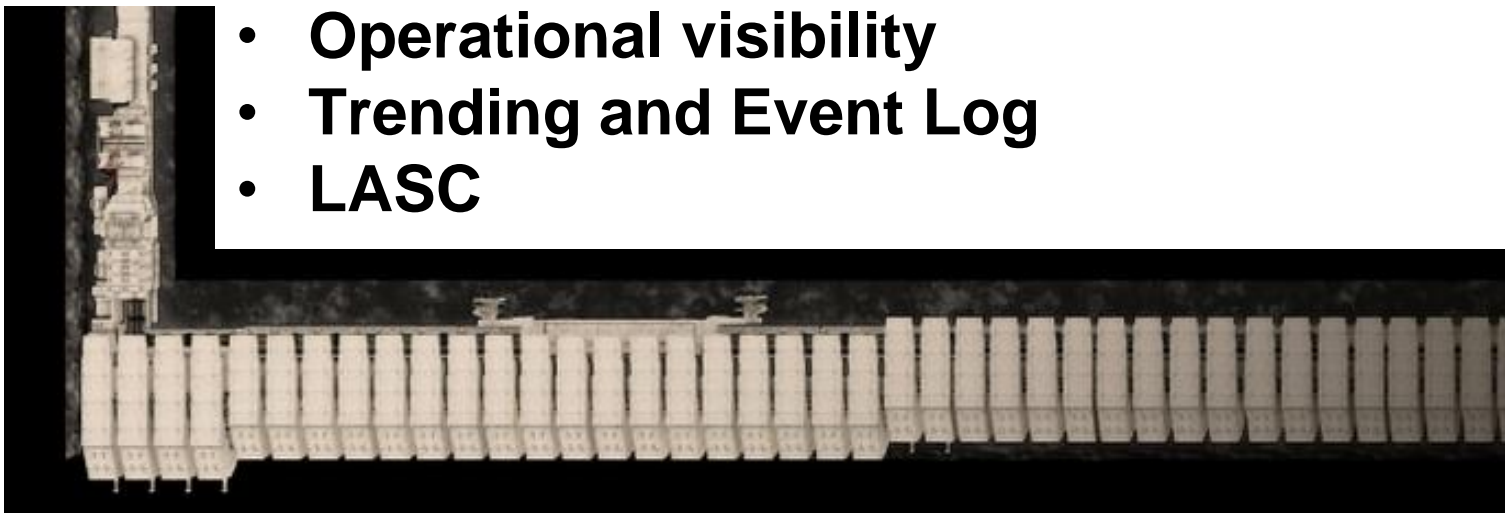


Application of Shearer Automation

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**



Carborough Downs
Integra Mine



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

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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.



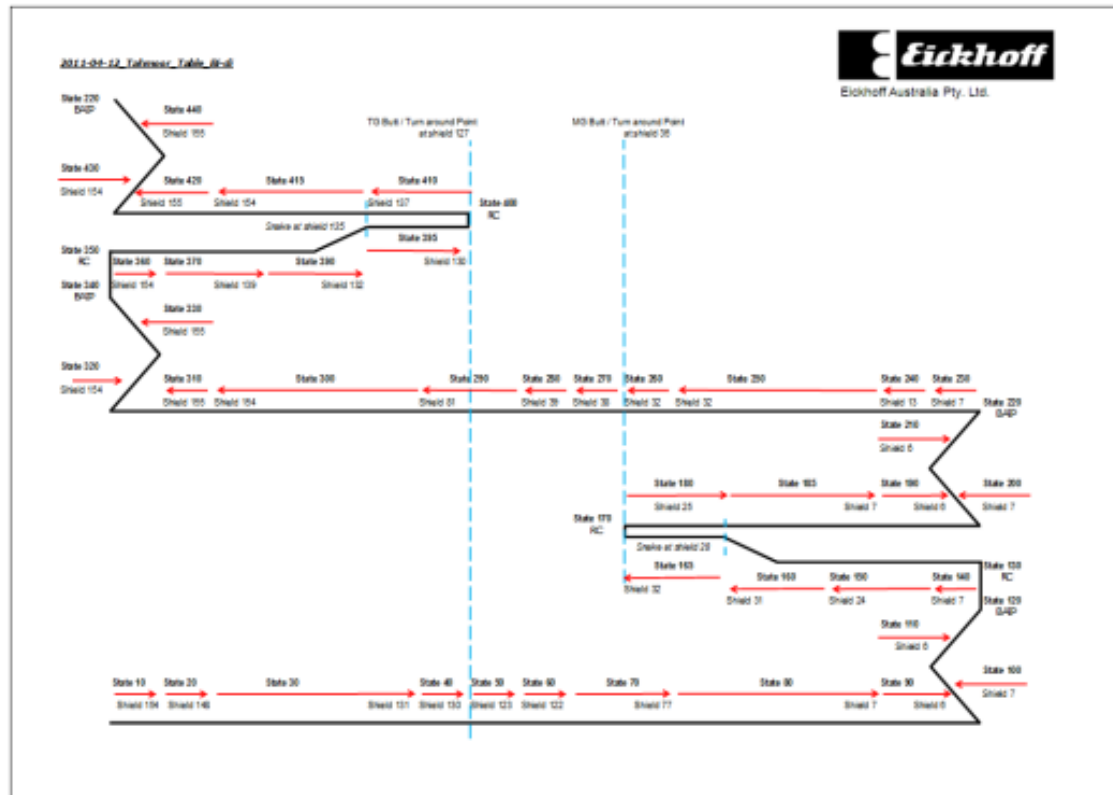
Carborough Downs
Integra Mine



Grasree



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



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Introduction

Aspects of longwall automation:

- Shearer State Based Automation

State No.: 390 Name RH Drum to cut roof in snake (E2P alt mode)

Haulage reaction: 10 [m/min] <=> | ==>

	Left	Right
Automation mode	PanFollow	FixExt
Altern. automation mode	ExToPrev	Unknown
Cowl [°]	0	0
Idle height [mm]	Use 0	Use 0
Roof height [mm]	Use 0	Use 0
Radio required	<input checked="" type="checkbox"/>	
Step limitation	<input checked="" type="checkbox"/> Undercut -100	<input type="checkbox"/> Uppercut 100
Water 1	<input type="checkbox"/>	
Water 2	<input type="checkbox"/>	

Transition 132 [Shield]

	Transition	State
Next state	Face Position 233.55 [m]	395
Altern. next state	Unknown 0 [sec]	0

Buttons: Delete state, Print, Copy state, Go to, Close

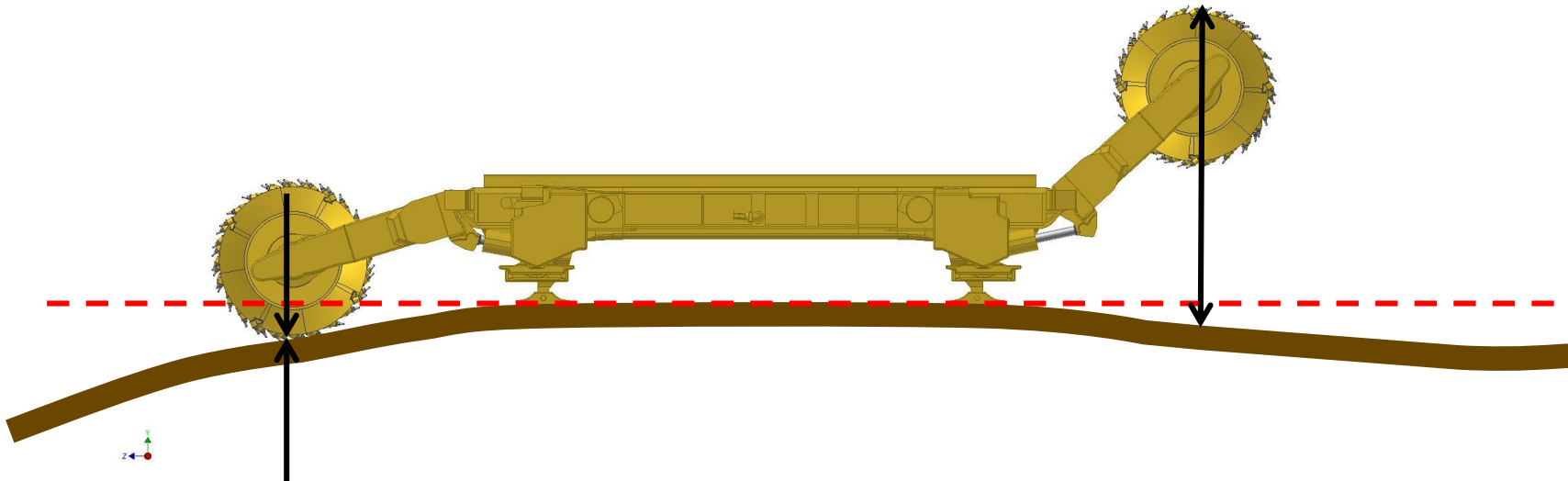
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Introduction

Aspects of longwall automation:

- **Shearer State Based Automation**

Drum height indication calculated and referred to the TRUE floor



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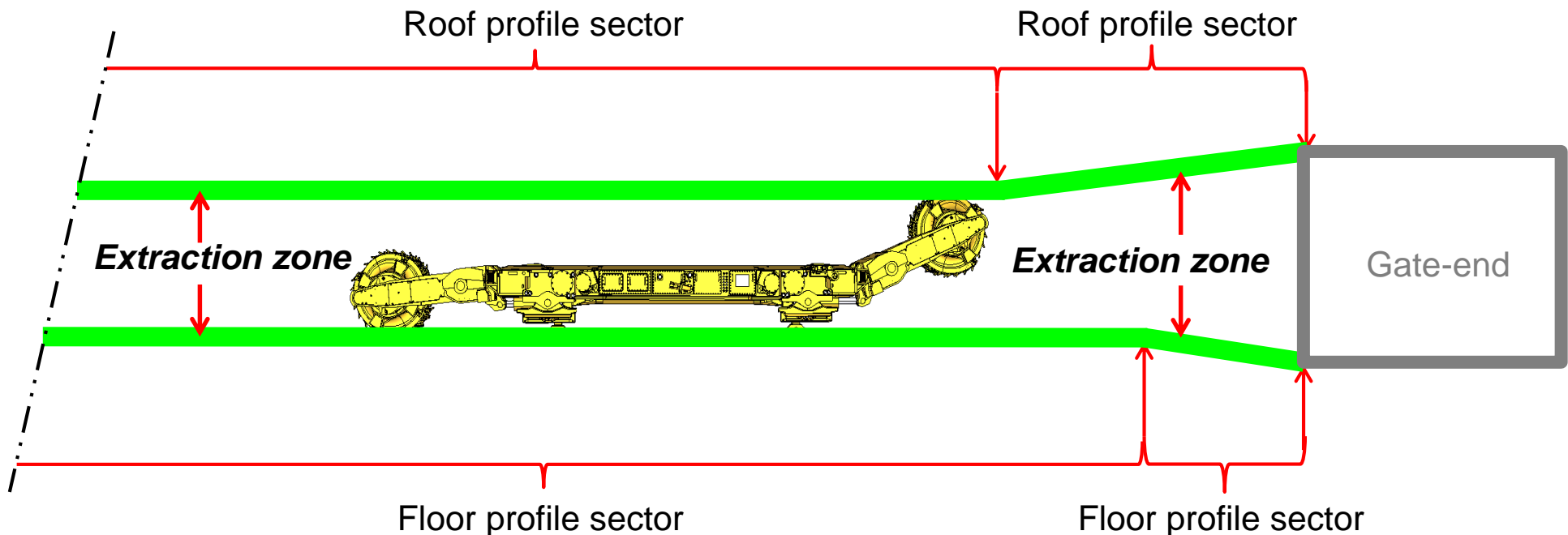
Introduction

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 -



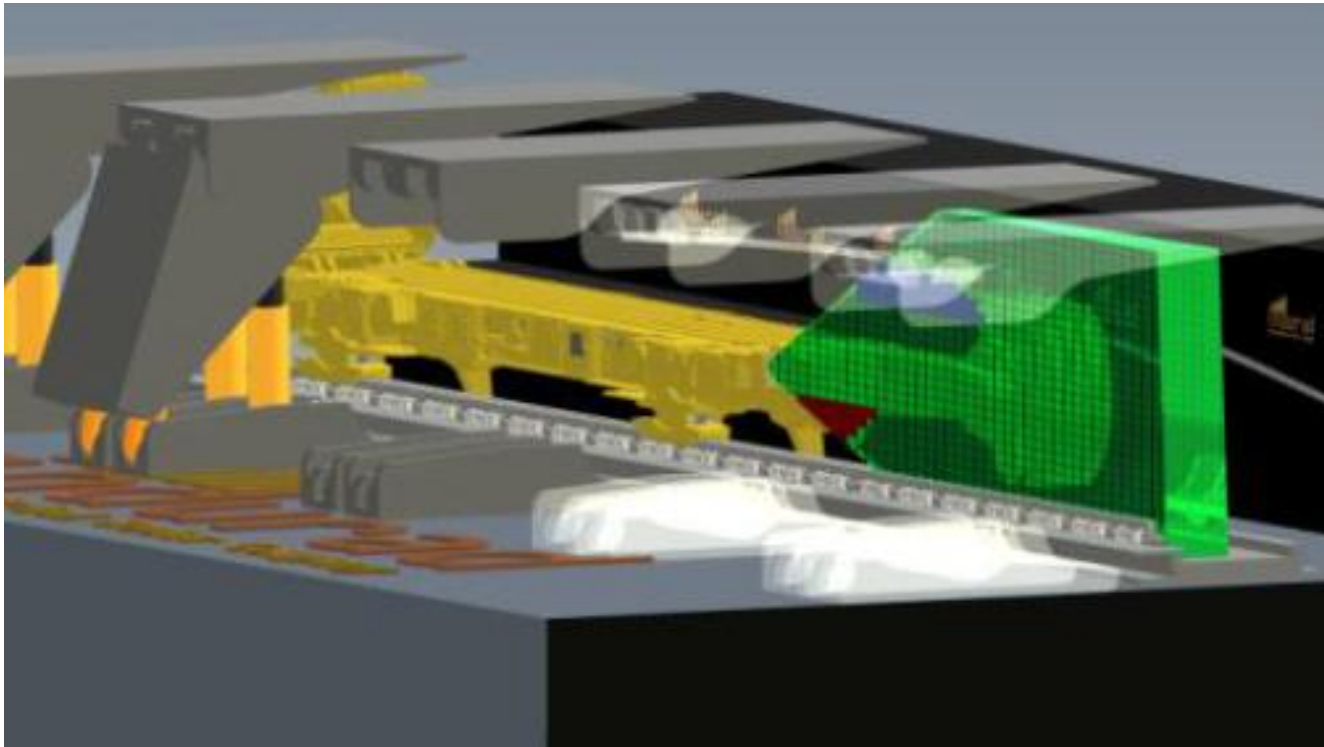
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Introduction

Aspects of longwall automation:

- **Radar detection**

Collision avoidance between cutting unit and shield canopies



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Introduction

Aspects of longwall automation:

- **Shield Automation**

By means of comms interfacing, shearer position is used for shield defined sequences which includes gate-ends.

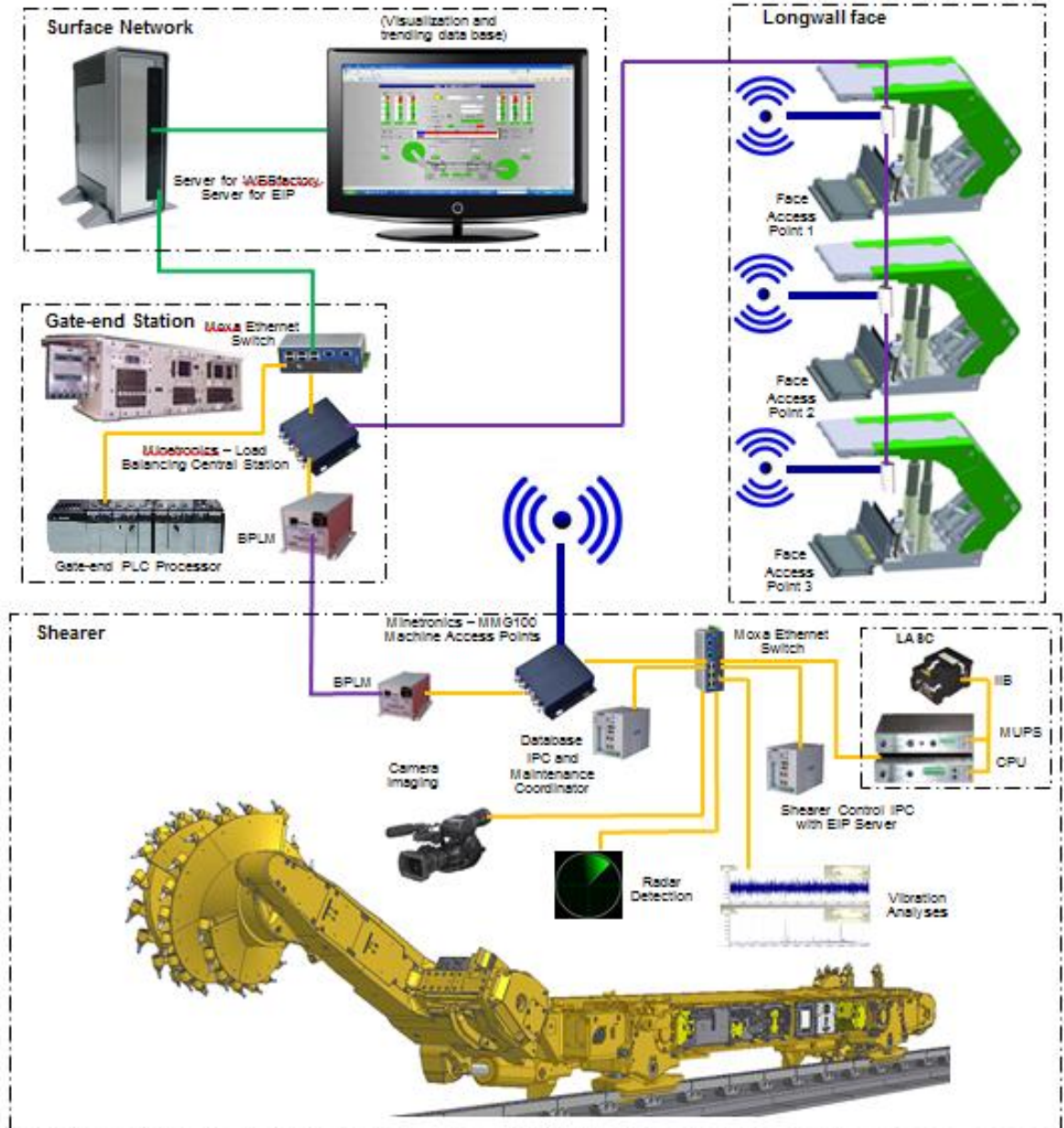


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Introduction

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

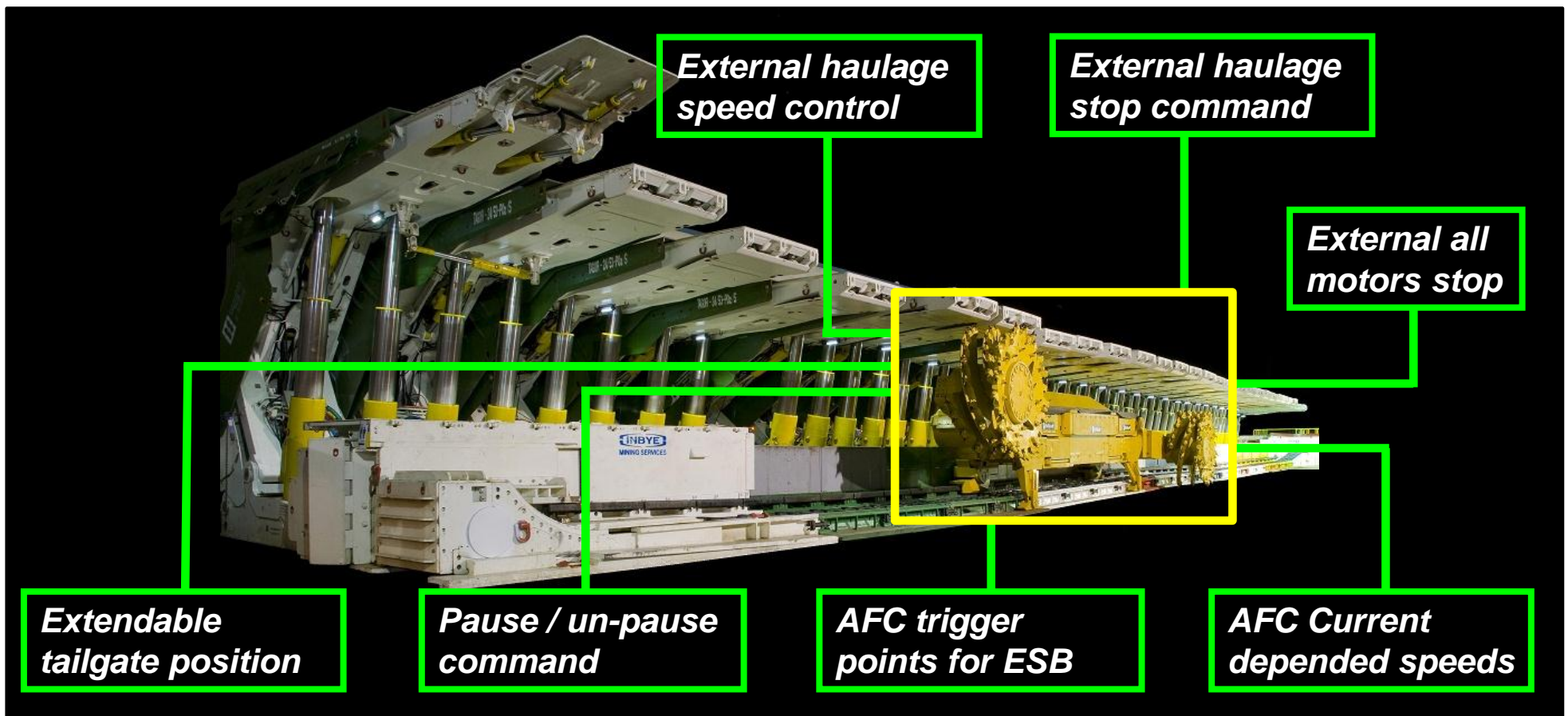


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Introduction

Aspects of longwall automation:

- EIP interface between equipment



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Introduction

Aspects of longwall automation:

- Operational visibility

On-board cameras



Web Visualization

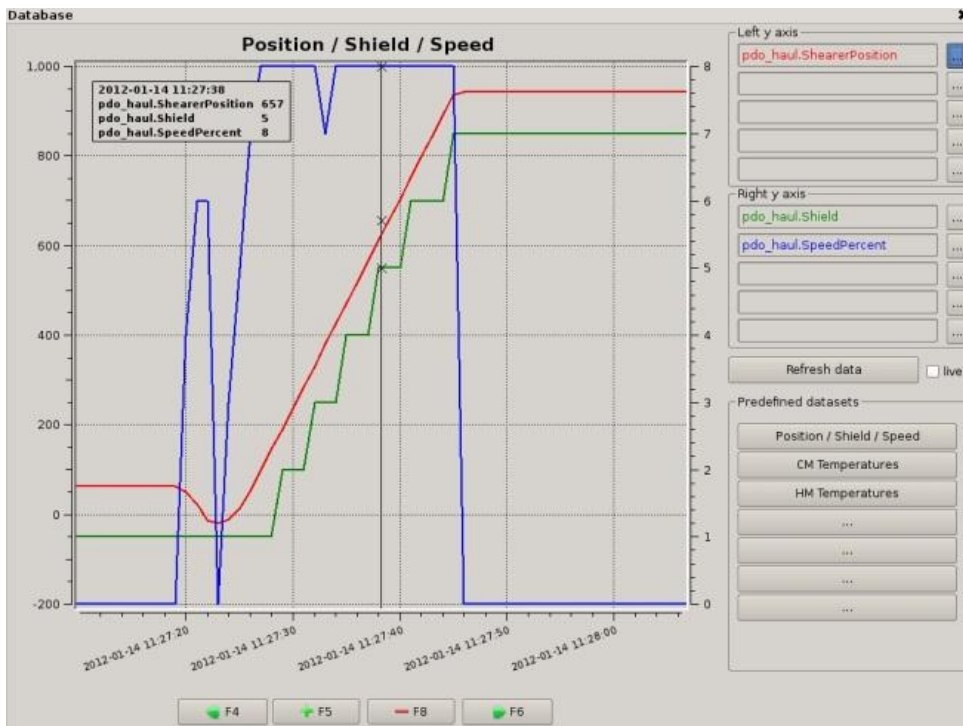


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Introduction

Aspects of longwall automation:

- Trending and Event Log



Parameter Log

Show from: 1/13/12 12:03 PM Choose parameter Apply filter

Show to: 1/14/12 12:03 PM

Time	Name	New Value	Old Value	User Machine	User Surface
2012-01-14 11:46:04.550	ShearerDimensions.InclinationTransverseOffset2.ActLimit	-5	0	Service	None
2012-01-14 11:46:04.550	ShearerDimensions.InclinationTransverseOffset1.ActLimit	-7	0	Service	None
2012-01-14 11:44:38.800	ShearerDimensions.InclinationLongitudinalOffset2.ActLimit	9	0	Service	None
2012-01-14 11:44:38.800	ShearerDimensions.InclinationLongitudinalOffset1.ActLimit	9	0	Service	None
2012-01-14 11:28:25.800	HAUL.UseInverseDirection.Disable	1	0	Service	None
2012-01-14 11:24:09.999	HML.LevelGearOilHaulagemaxTripping.Disable	1	0	Service	None
2012-01-14 11:24:09.999	HML.LevelGearOilHaulageminTripping.Disable	1	0	Service	None
2012-01-14 11:24:09.999	HML.LevelGearOilHaulagemaxTripping.Disable	1	0	Service	None
2012-01-14 11:24:09.999	HML.LevelGearOilHaulageminTripping.Disable	1	0	Service	None
2012-01-14 11:23:18.0	WATER.CameraSprayRH.Disable	1	0	Service	None
2012-01-14 11:23:18.0	WATER.CameraSprayLH.Disable	1	0	Service	None
2012-01-14 11:23:18.0	WATER.PressureDrumSprayRHmaxTripping.Disable	1	0	Service	None
2012-01-14 11:23:18.0	WATER.PressureDrumSprayRHminTripping.Disable	1	0	Service	None
2012-01-14 11:23:18.0	WATER.FlowDrumSprayRHmaxTripping.Disable	1	0	Service	None
2012-01-14 11:23:18.0	WATER.FlowDrumSprayRHminTripping.Disable	1	0	Service	None
2012-01-14 11:23:18.0	WATER.PressureDrumSprayLHmaxTripping.Disable	1	0	Service	None
2012-01-14 11:23:18.0	WATER.PressureDrumSprayLHminTripping.Disable	1	0	Service	None
2012-01-14 11:23:18.0	WATER.FlowDrumSprayLHmaxTripping.Disable	1	0	Service	None
2012-01-14 11:23:18.0	WATER.FlowDrumSprayLHminTripping.Disable	1	0	Service	None
2012-01-14 11:23:18.0	WATER.PressureWaterInletminTripping.Disable	1	0	Service	None
2012-01-14 11:23:18.0	WATER.PressureCoolingWaterminTripping.Disable	1	0	Service	None

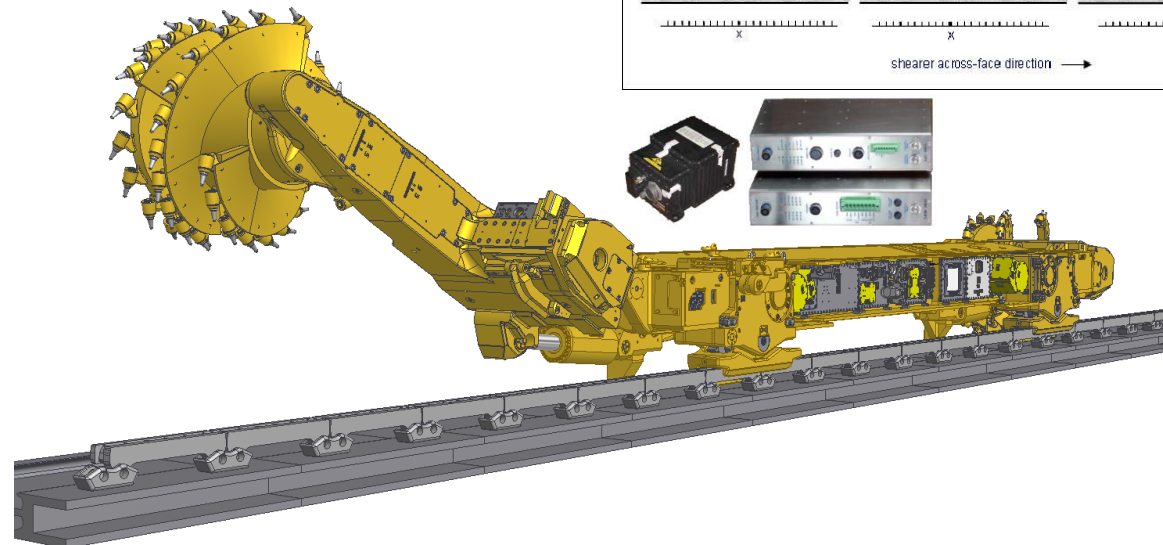
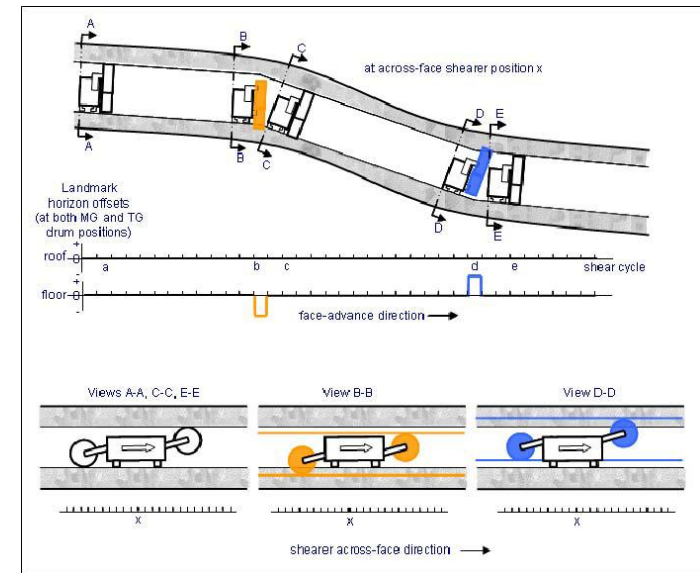
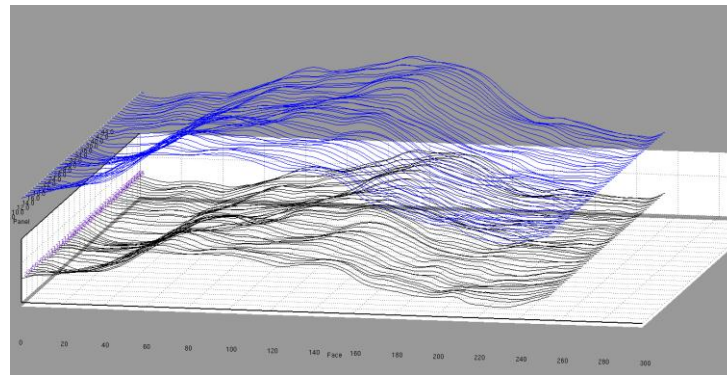
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Aspects of longwall automation:

- **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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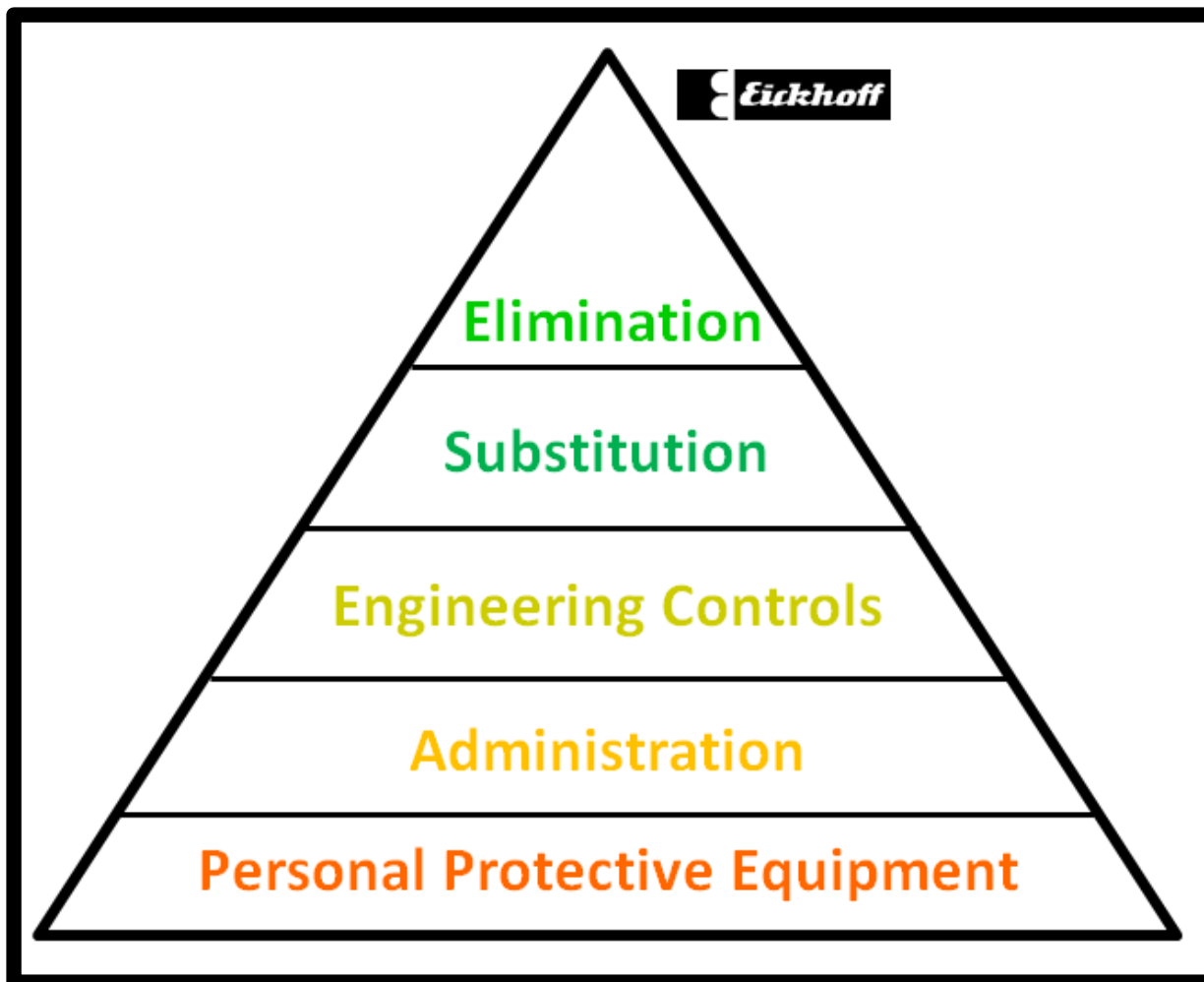
Immediate objectives for automation



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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

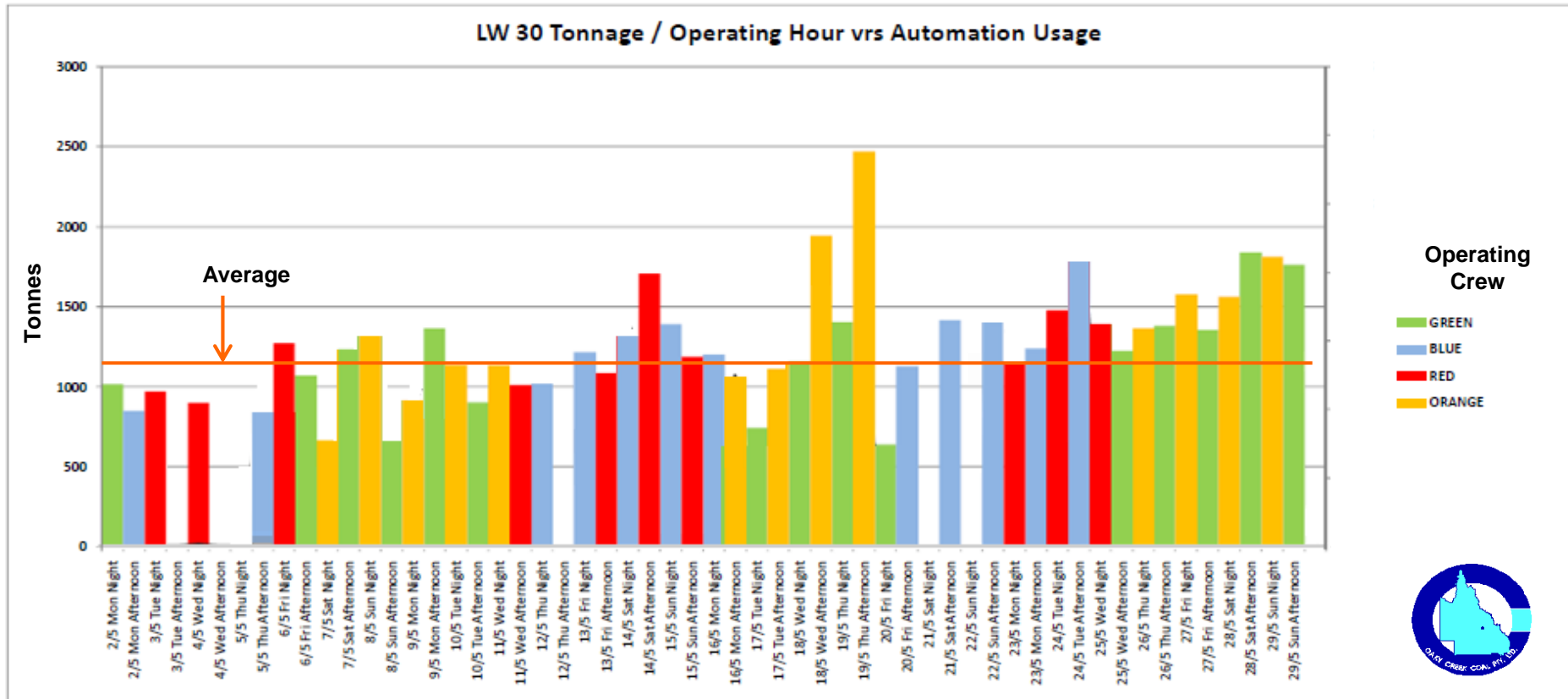
To maintain consistency in longwall production

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



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Immediate objectives for automation



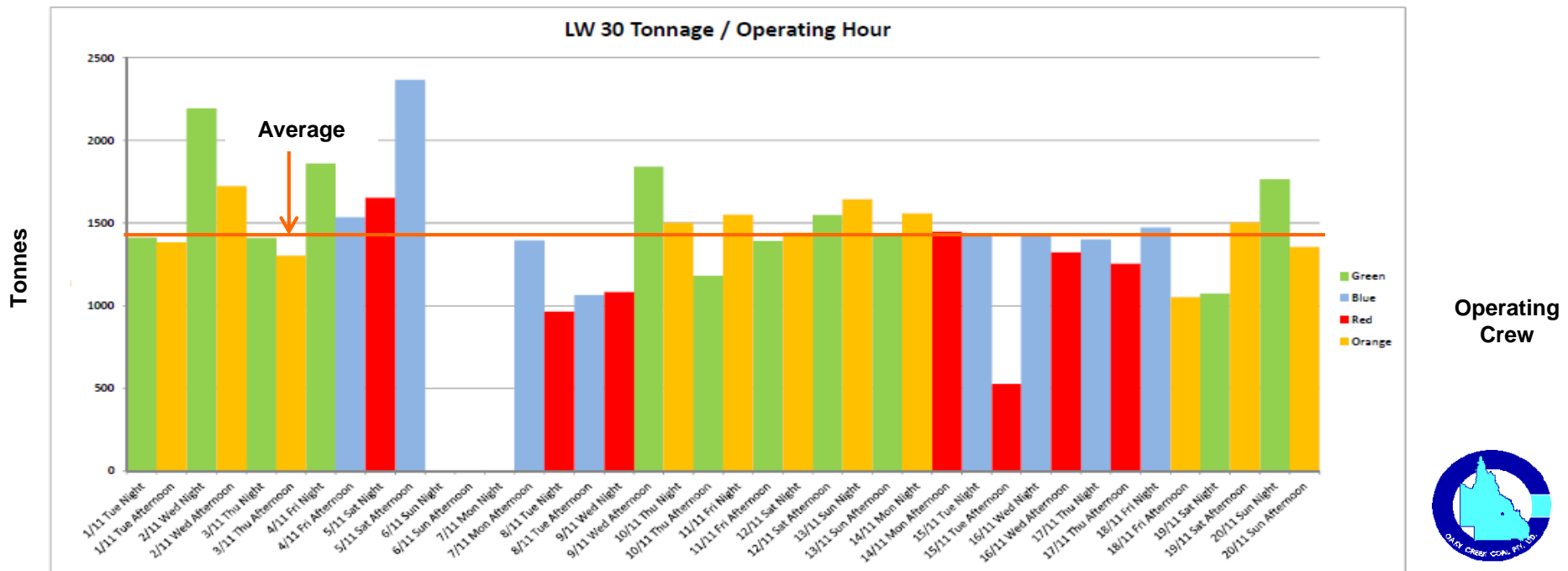
- OCC #1 Tonnes / Operating Hour (May 2011)



Application of Shearer Automation

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

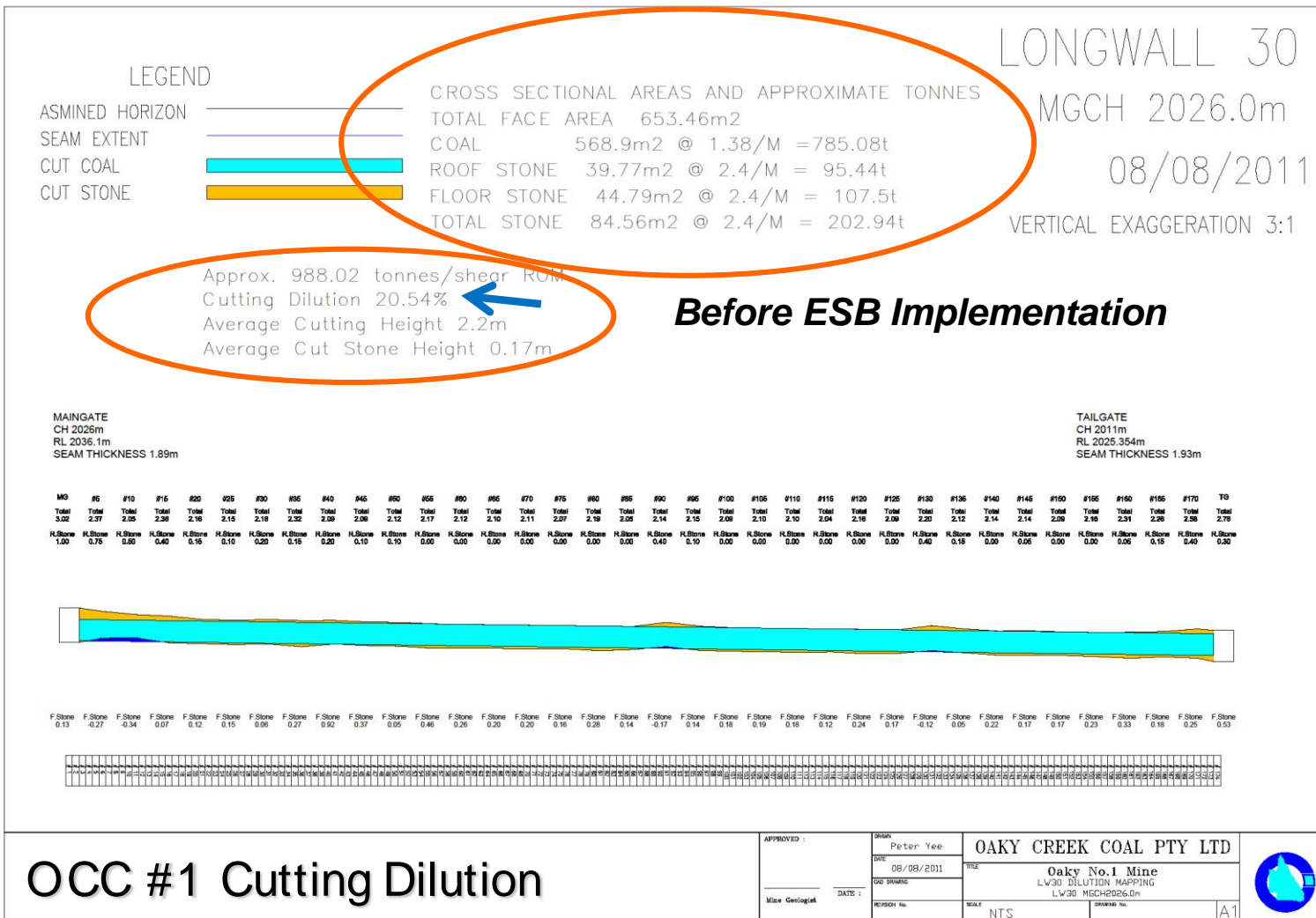


- OCC #1 SCA DA TRENDS – Haulage speed reduction vs. Methane

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Immediate objectives for automation

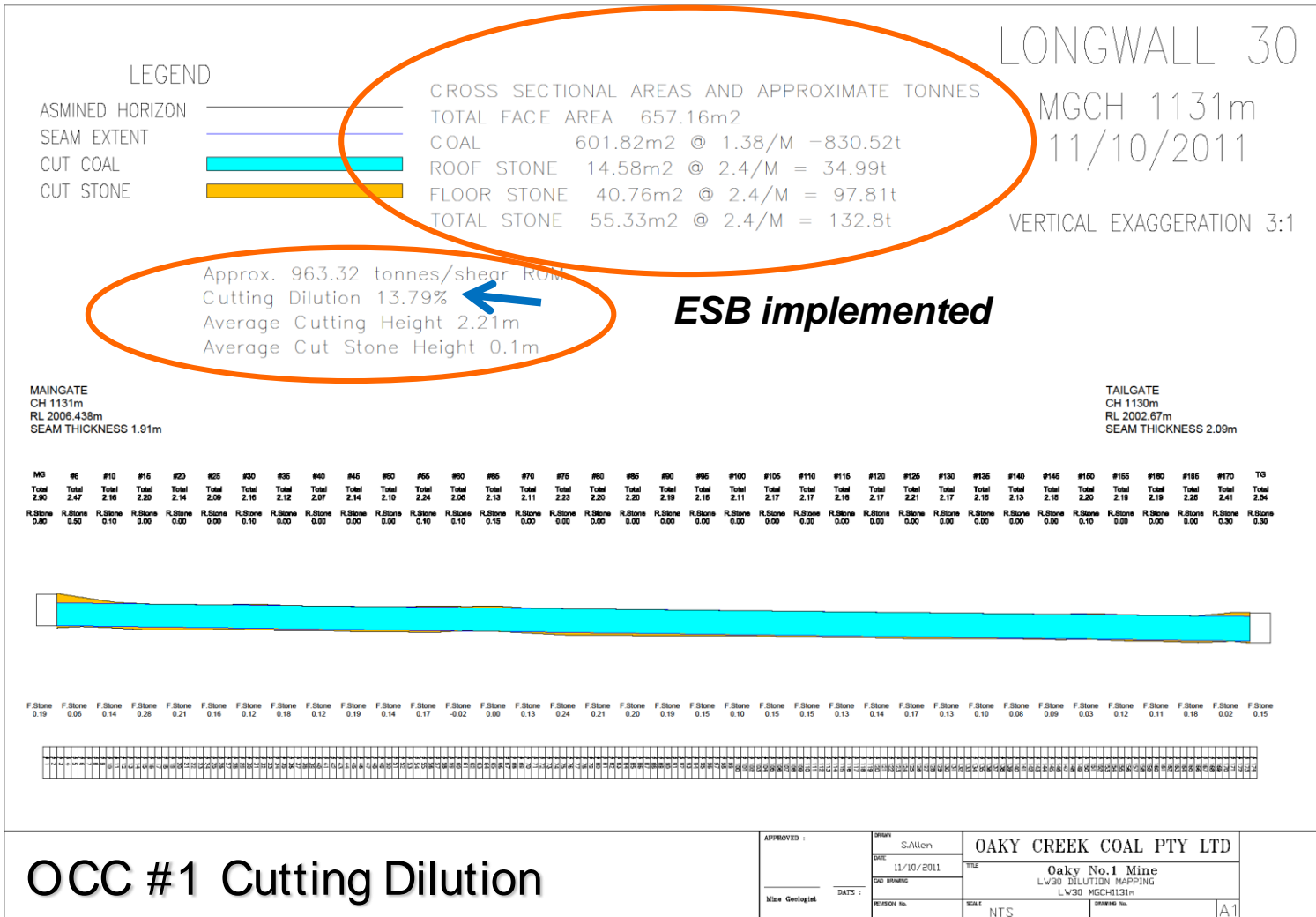
To maintain consistency in longwall production



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Immediate objectives for automation

To maintain consistency in longwall production



Application of Shearer Automation

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



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Courtesy Carborough Downs 2009 25

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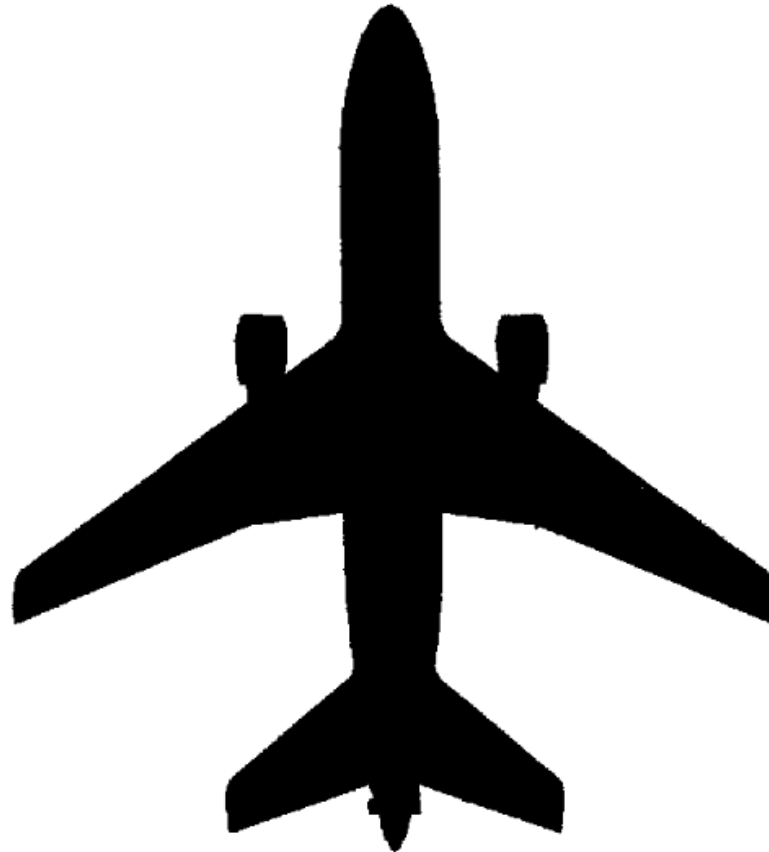
Requirements for effective automation



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Requirements for effective automation

Redundancy of automation components



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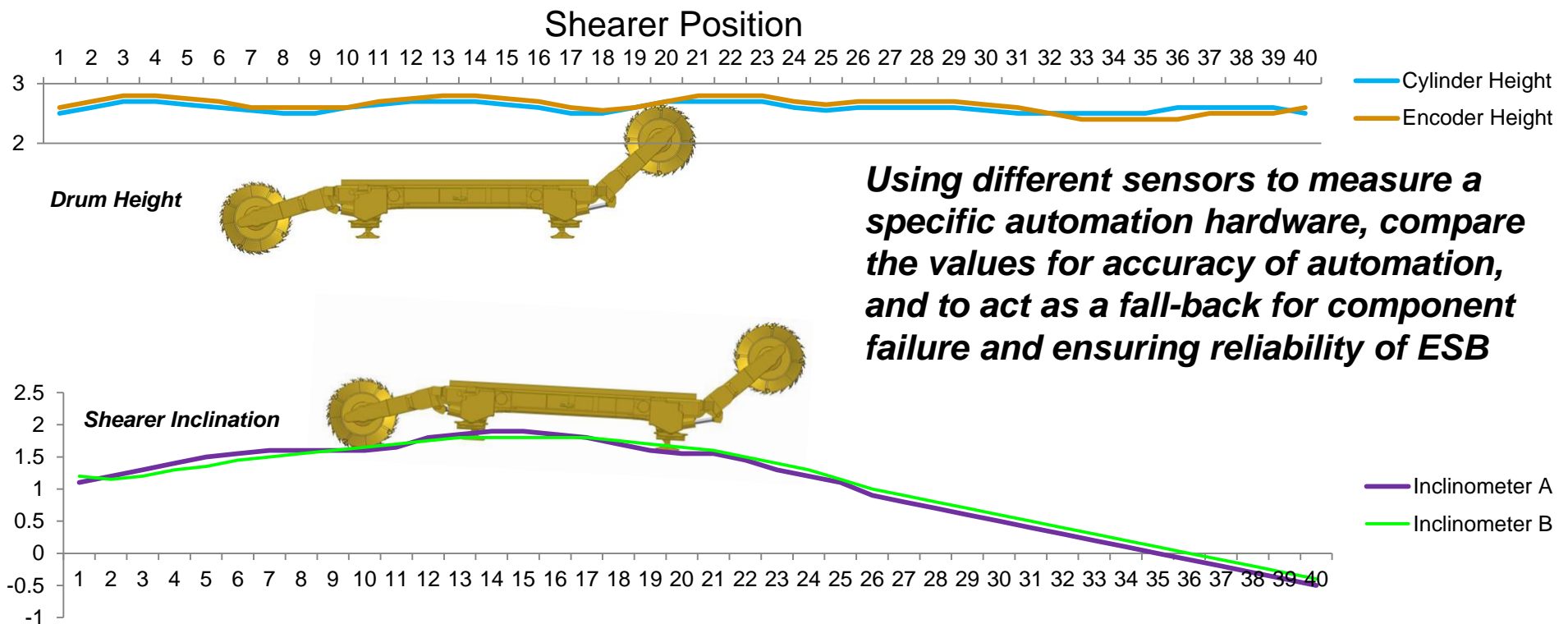
Requirements for effective automation

Redundancy of automation components



Tahmoor Colliery

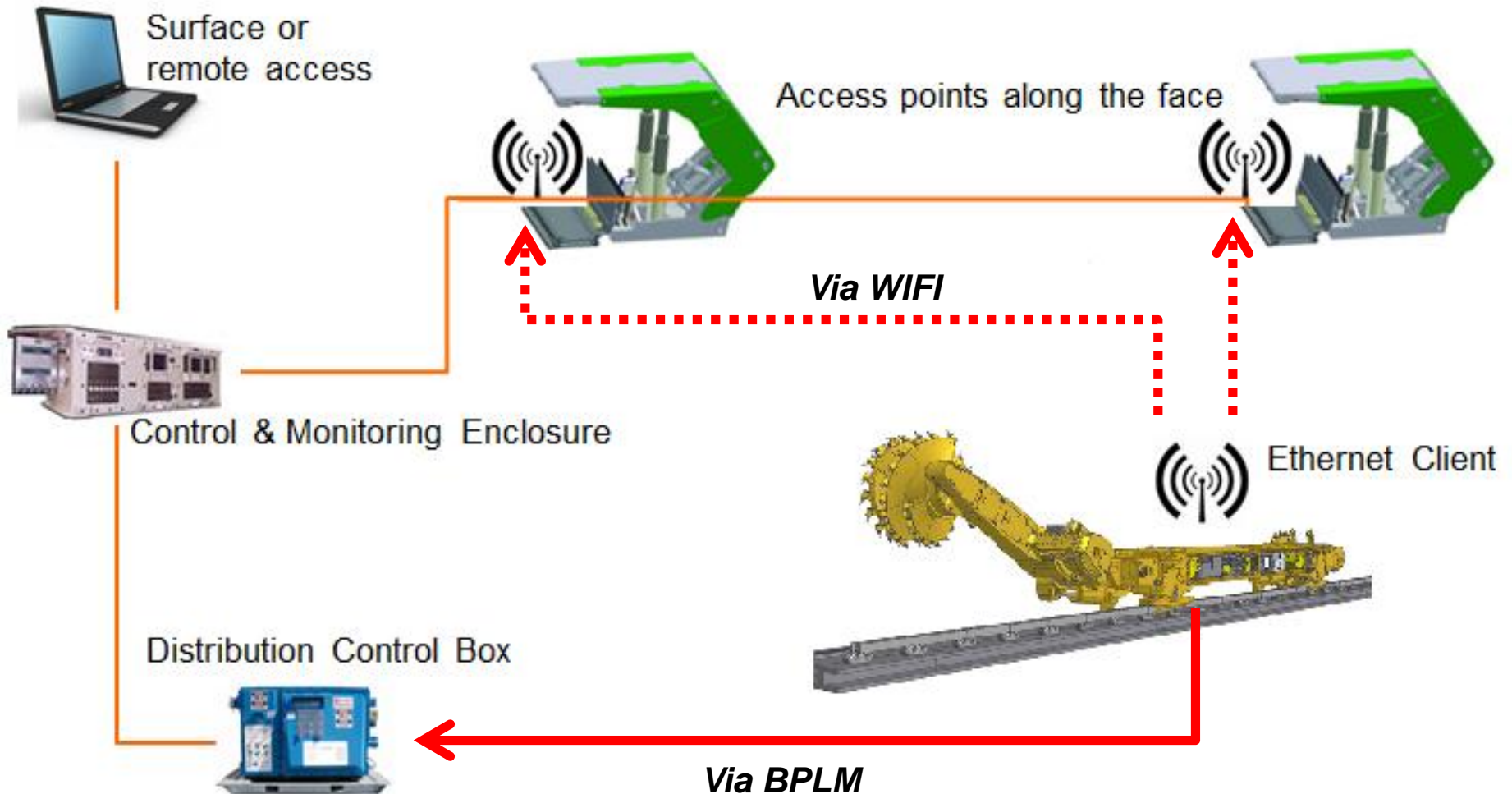
- **Sensor redundancy**



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Requirements for effective automation

Redundancy of automation components



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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



How the customer explained it



How Marketing proposed it



How the analyst designed it



How the programmer wrote it



What the beta testers received



How the business consultant described it



What operations installed



How it performed under load



When it was delivered



What the customer really wanted



The disaster recover 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.**



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xstrata

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Requirements for effective automation

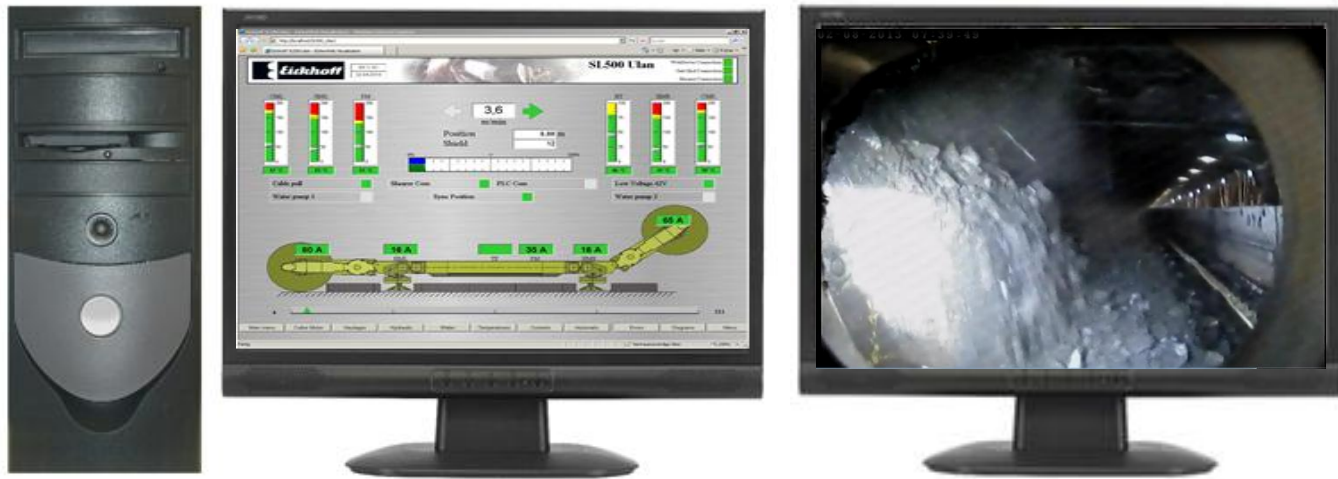
Clear visibility of what exactly occurs in the longwall



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Requirements for effective automation

Clear visibility of what exactly occurs in the longwall



Application of Shearer Automation

Requirements for effective automation

Clear visibility of what exactly occurs in the longwall

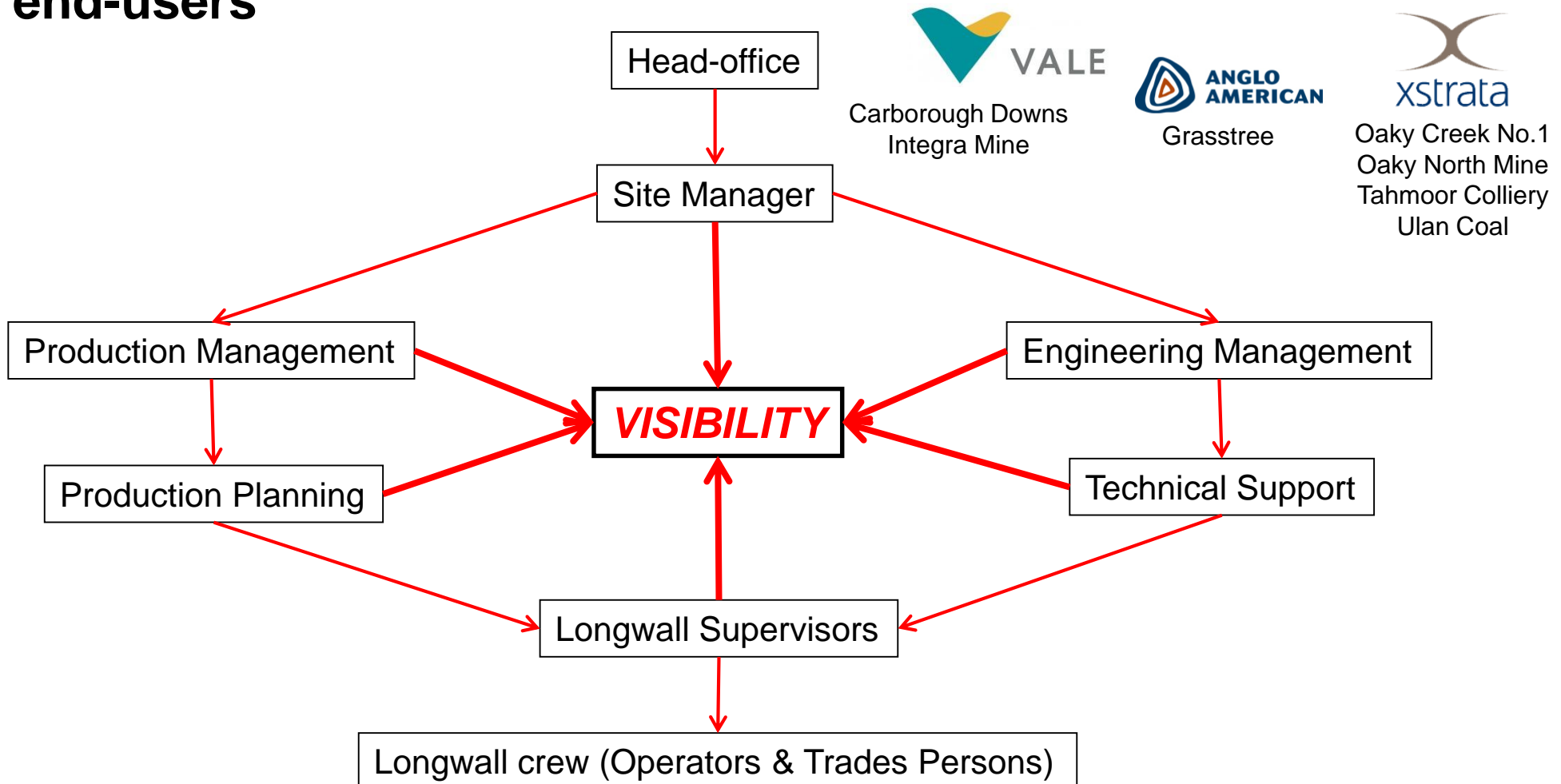
Regular underground representation – Support agreements with the OEM



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Requirements for effective automation

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



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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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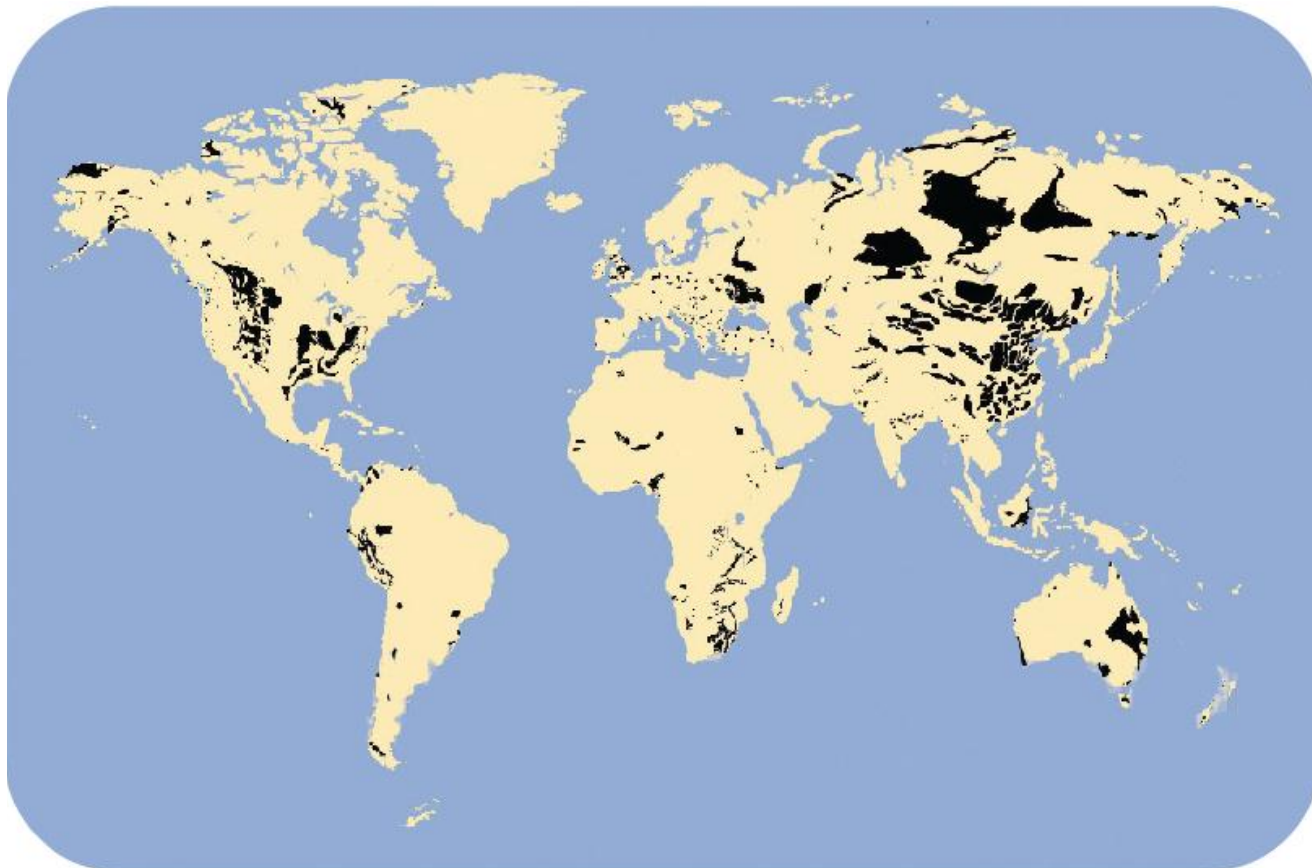
The challenge we currently face!!



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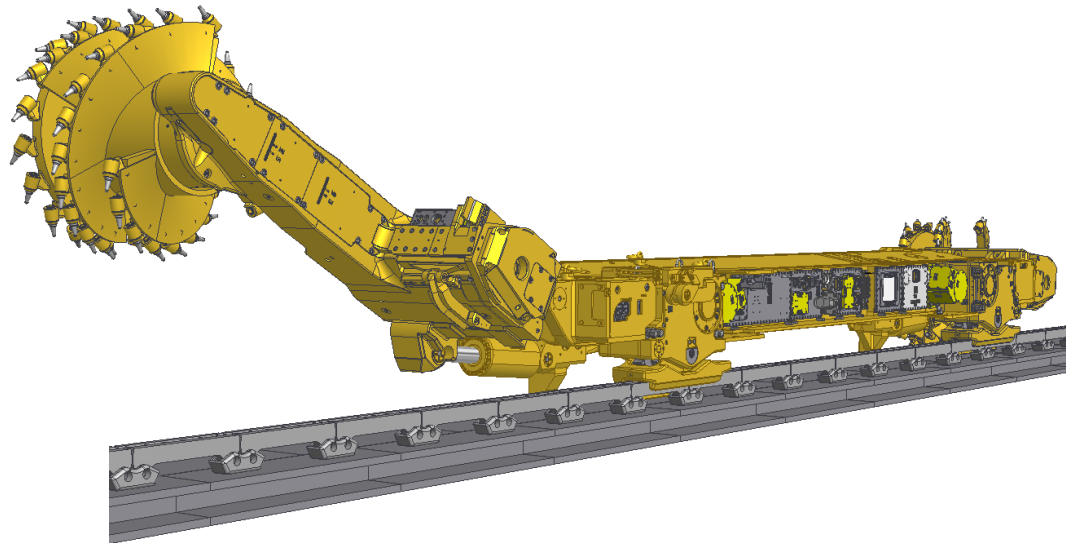
Challenges within automation

A large amount of shearers are installed in longwalls globally



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Shearers equipped with class-leading technologies???



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.



Application of Shearer Automation

*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.



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www.eickhoff-international.com



"Automation makes mining safer"

Eickhoff SL Shearer Series

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

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