GLENCORE

Gate Road Development Experience Using Continuous Haulage – 4FCT

Glencore's Ulan West Mine

Longwall USA – Pittsburgh May 2019

Agenda

- Glencore in Australia
- Ulan West Mine Overview
- Ulan West Mine Development History
- 4FCT Development system general arrangement
- 4FCT System performance data analysis MG03-MG05
- Equipment Challenges / Major incidents
- Summary of findings
- Discussion / Questions

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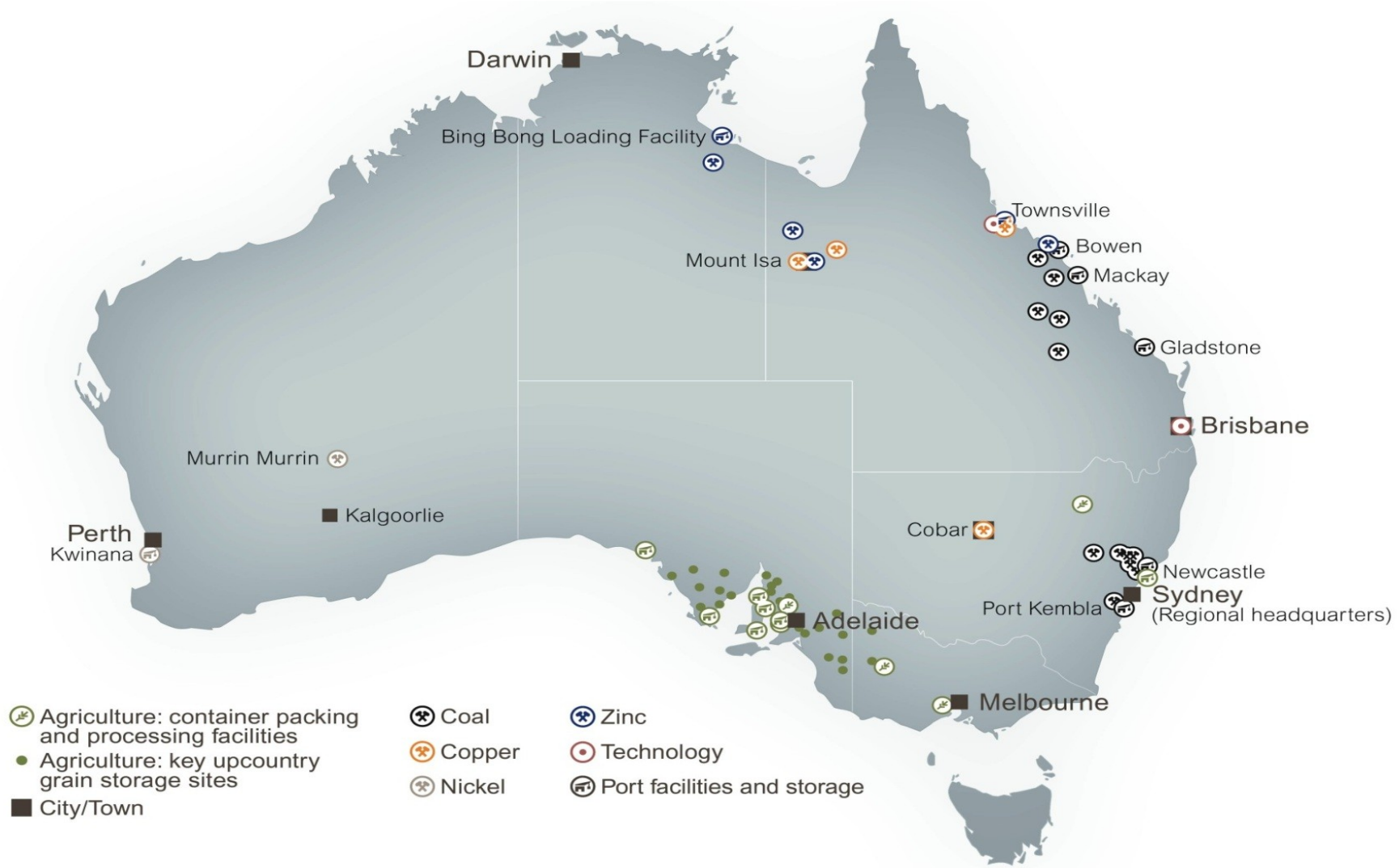
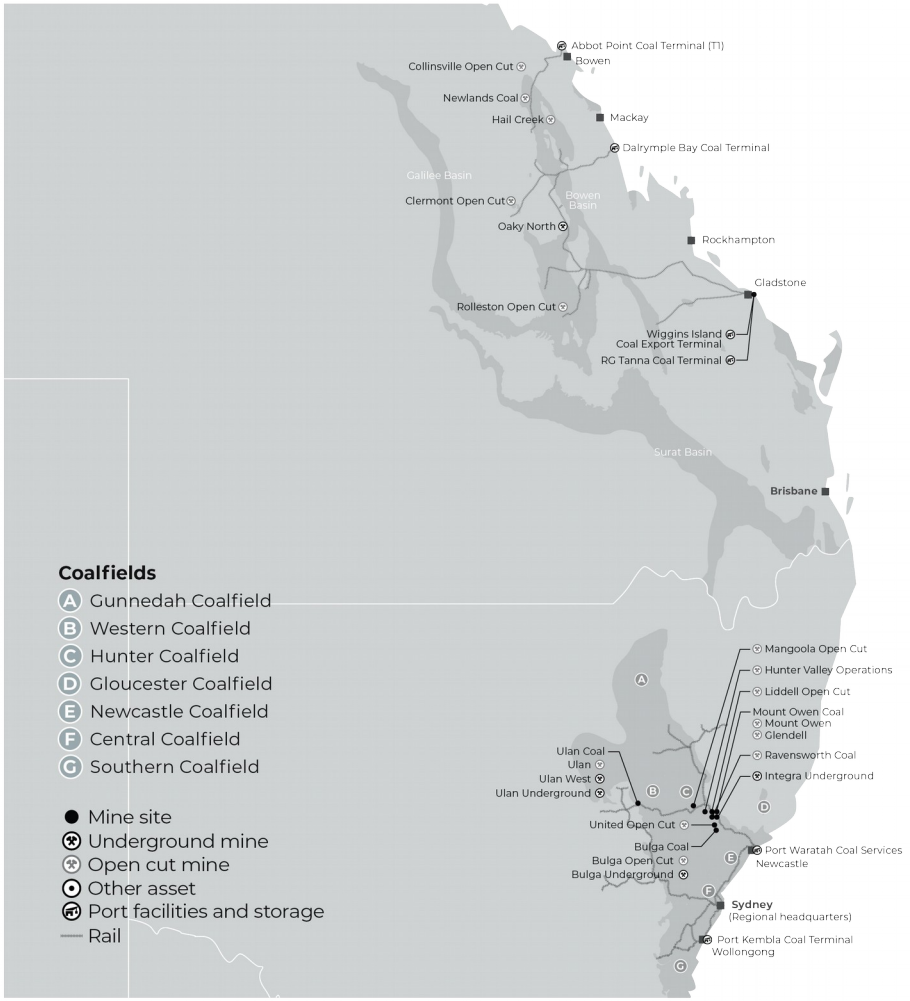
Glencore in Australia



Australian coal operations

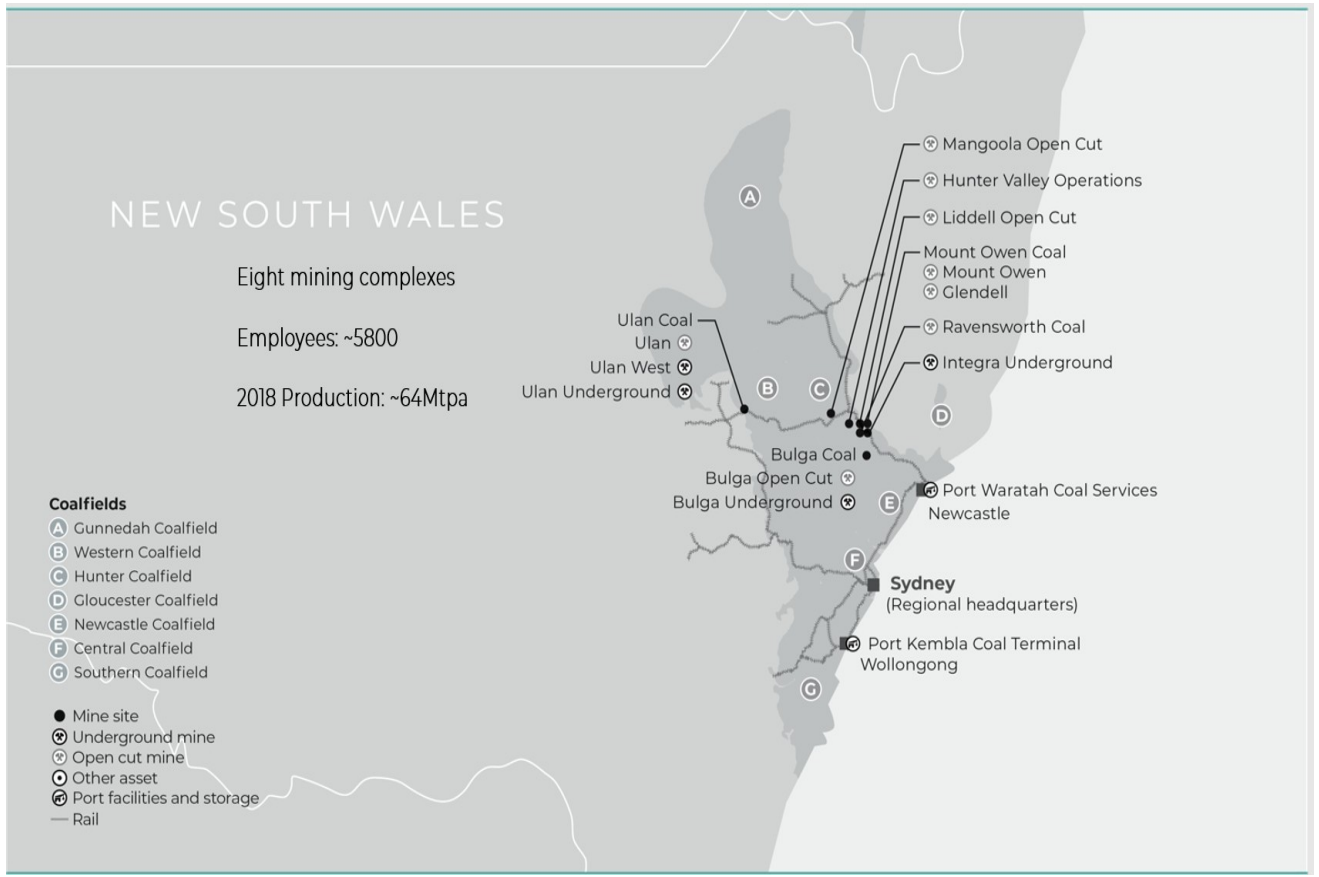


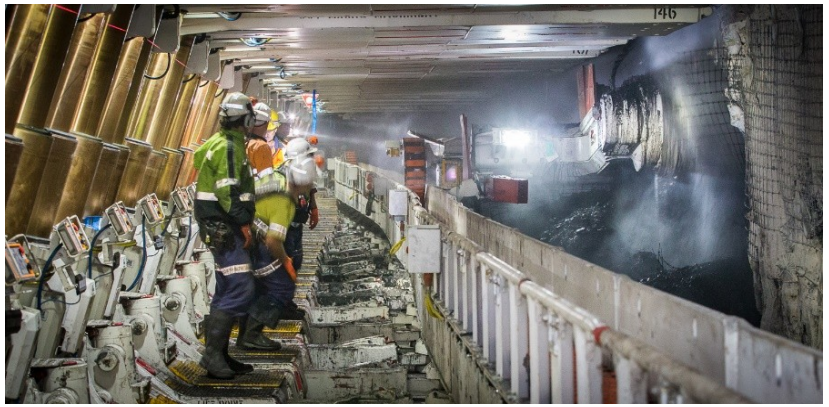
Coal in NSW

Ulan West Mine Location

Ulan West is an underground coal mine part of the Ulan Complex located approx. 4hrs west of Sydney and Newcastle in central NSW

Ulan West accesses the Port in Newcastle via rail for export





Ulan West Mine

Background

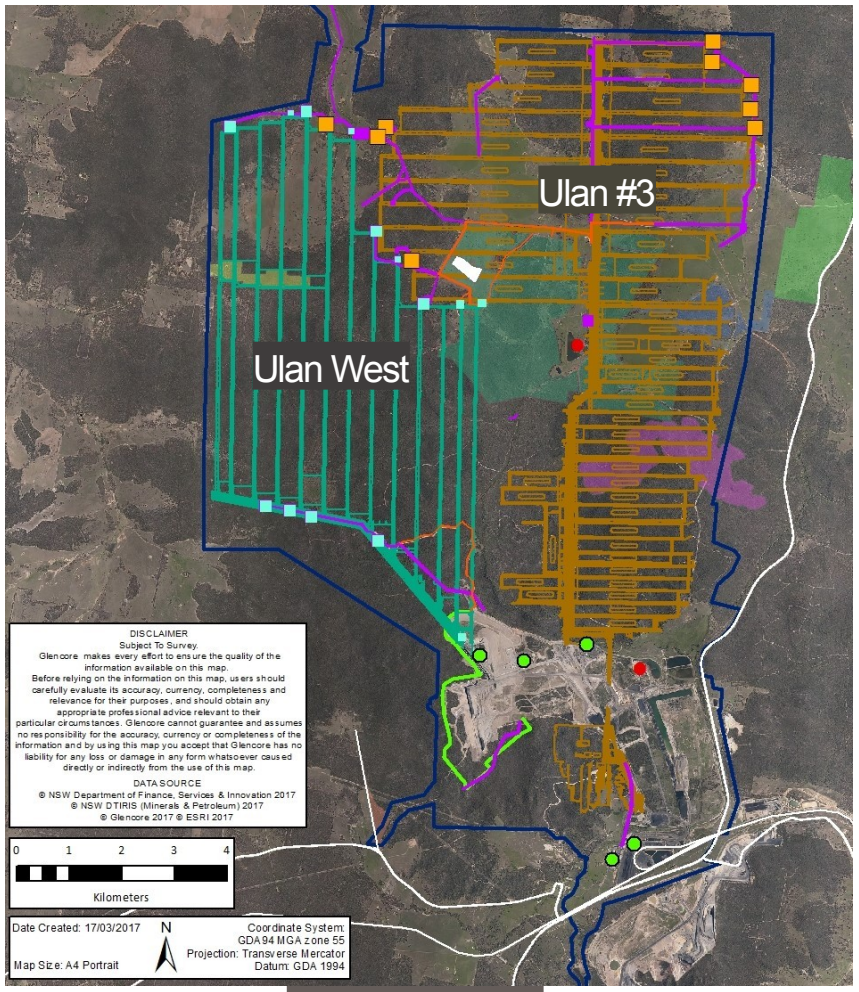
Development of a new underground coal mine within the Ulan Coal Mines Complex

Located immediately west of current Ulan Underground

Extraction of coal using a high capacity longwall system (400m/1320ft wide)

LW Panels 1 - 12 range from 5.8km - 8km (3.7- 5 miles) in length with Block ROM 7-14Mt

Operate Monday – Friday Roster for production with a plan to produce 6-7Mt of ROM coal per year



Ulan Coal Mines

Ulan West Mine

Current Operations

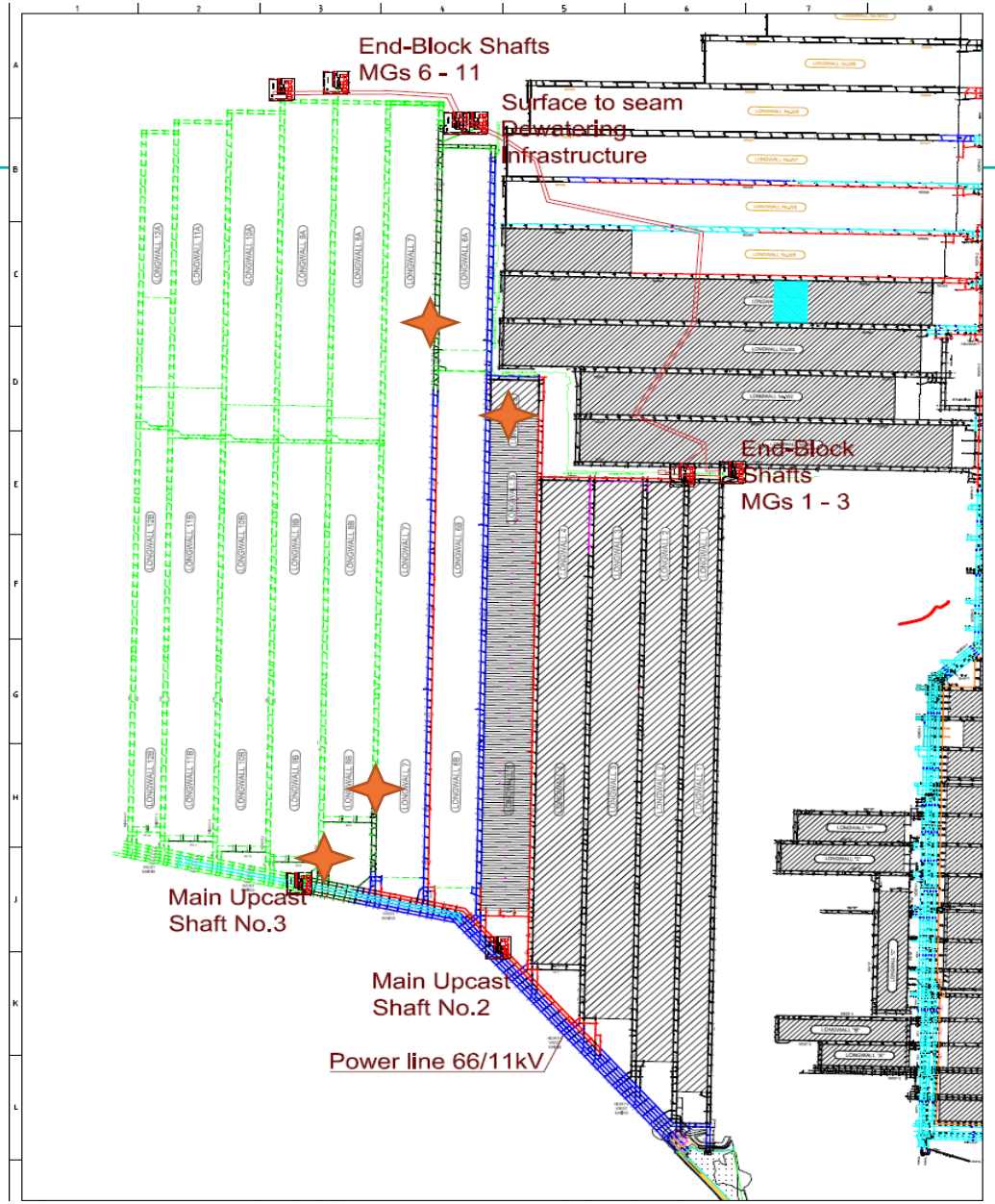
1. LW05 currently in operation
   Joy LW PRS, 7LS Shearer

2. MG06 Development Unit
   Sandvik MB650 Miner, Joy 12CM30 Miner, 10SC42 Shuttle Car

3. MG07 Development Unit
   Sandvik MB650 Miner, 10SC42 Shuttle Car

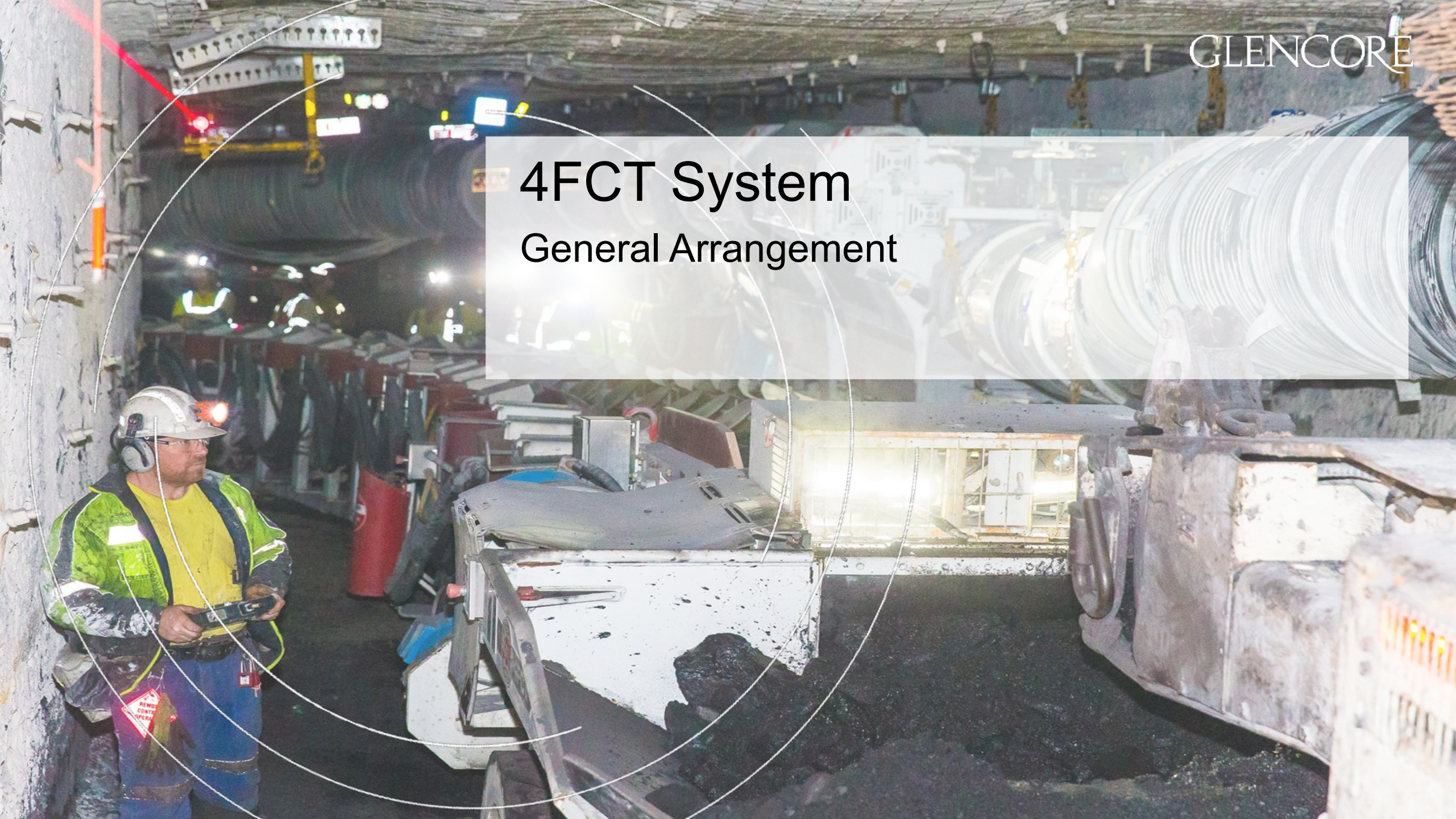
4. Mains Development
   Joy 12CM30 Miner, 10SC43 Shuttle Car

4FCT Currently out of mine for Overhaul since completing MG05



Development History

Panel Location	Mains / TG01 / MG01	MG02	MG03	MG04	MG05	MG06	MG07
Miner	12CM30	12CM30	12CM30	12CM30	MB650	MB650 12CM30	MB650
Haulage	Shuttle Car Feeder Breaker	Shuttle Car Feeder Breaker	4FCT	4FCT	4FCT	2 X Shuttle Car Feeder Breaker	Shuttle Car Feeder Breaker
Ventilation	Conventional	Monorail	Monorail	Monorail	Monorail	Conventional	Conventional
Power	Conventional	Monorail	Monorail	Monorail	Monorail	Conventional	Conventional

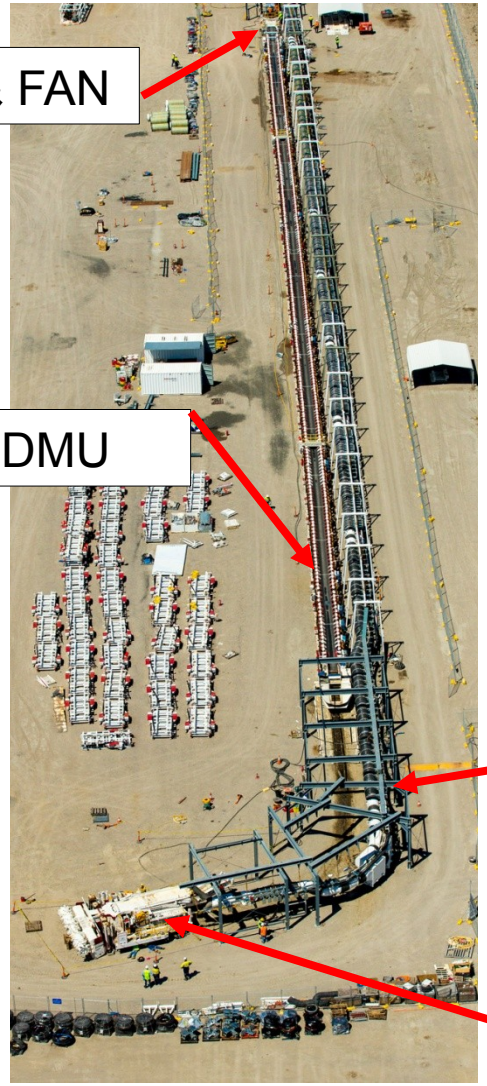


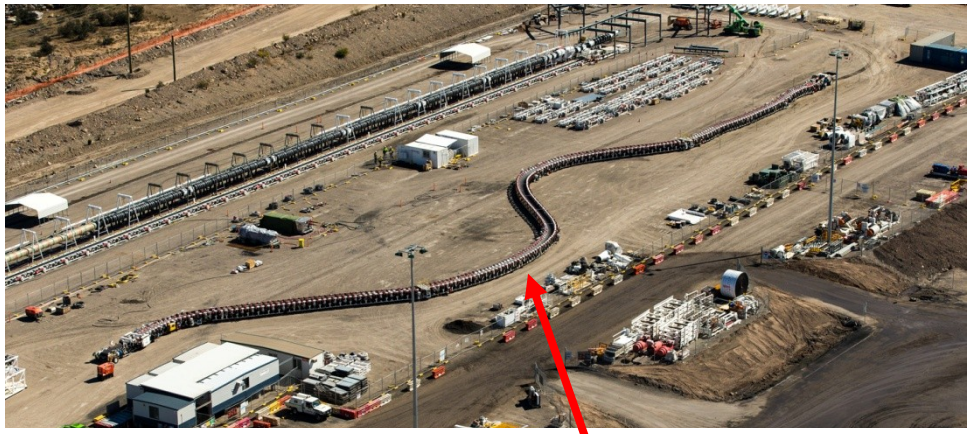
4FCT System

General Arrangement

FCT System

General Arrangement





FCT System

General Arrangement

Machine Logic..

FCT;

- Mobile conveyor mounted on a traction chain
- Follows Continuous Miner through out pillar sequence
- Transfers coal from Continuous Miner to DMU
- Remote control operated

DMU;

- Launch pad for FCT
- Provides dynamic coal transfer point from FCT
- Used to advance FCT and panel conveyor belt during panel advance
- Remote control operated

4FCT installation

Mine plans & Layout

Transport layout and installation for typical Gate Road Panel

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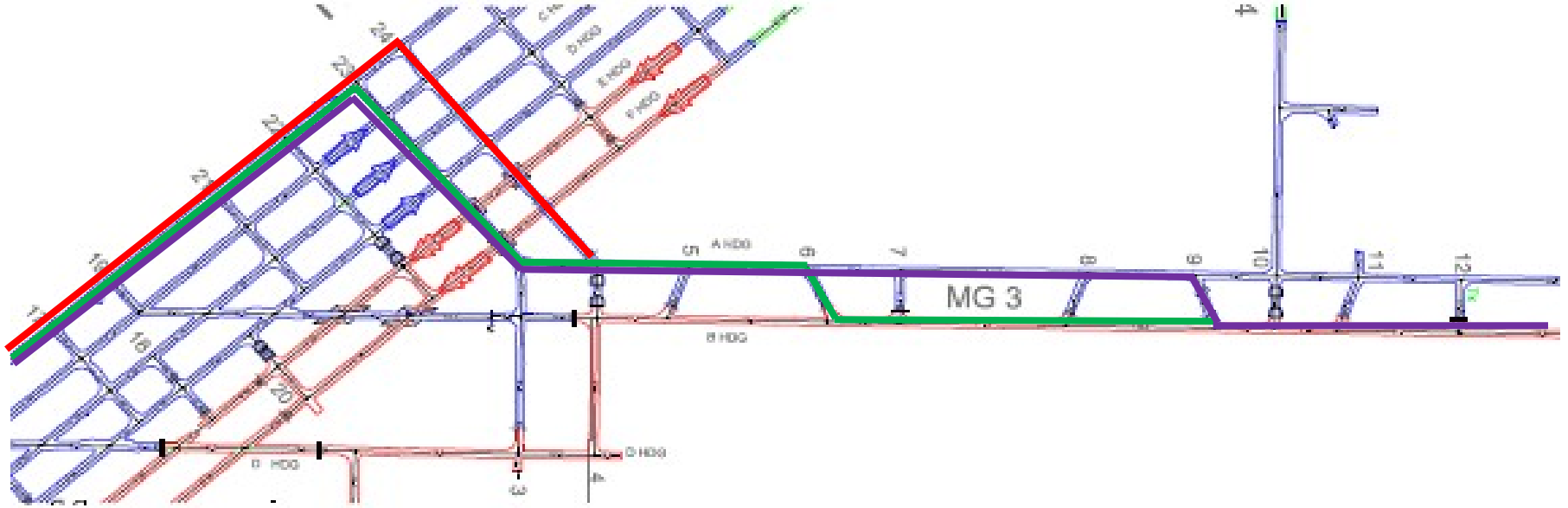


Monorail transport route

DMU frame transport route

FCT transport route

4FCT Unit Performance Analysis

MG03, MG04 and MG05

4FCT Panel Performance – MG03, MG04, MG05

Statistics and Data

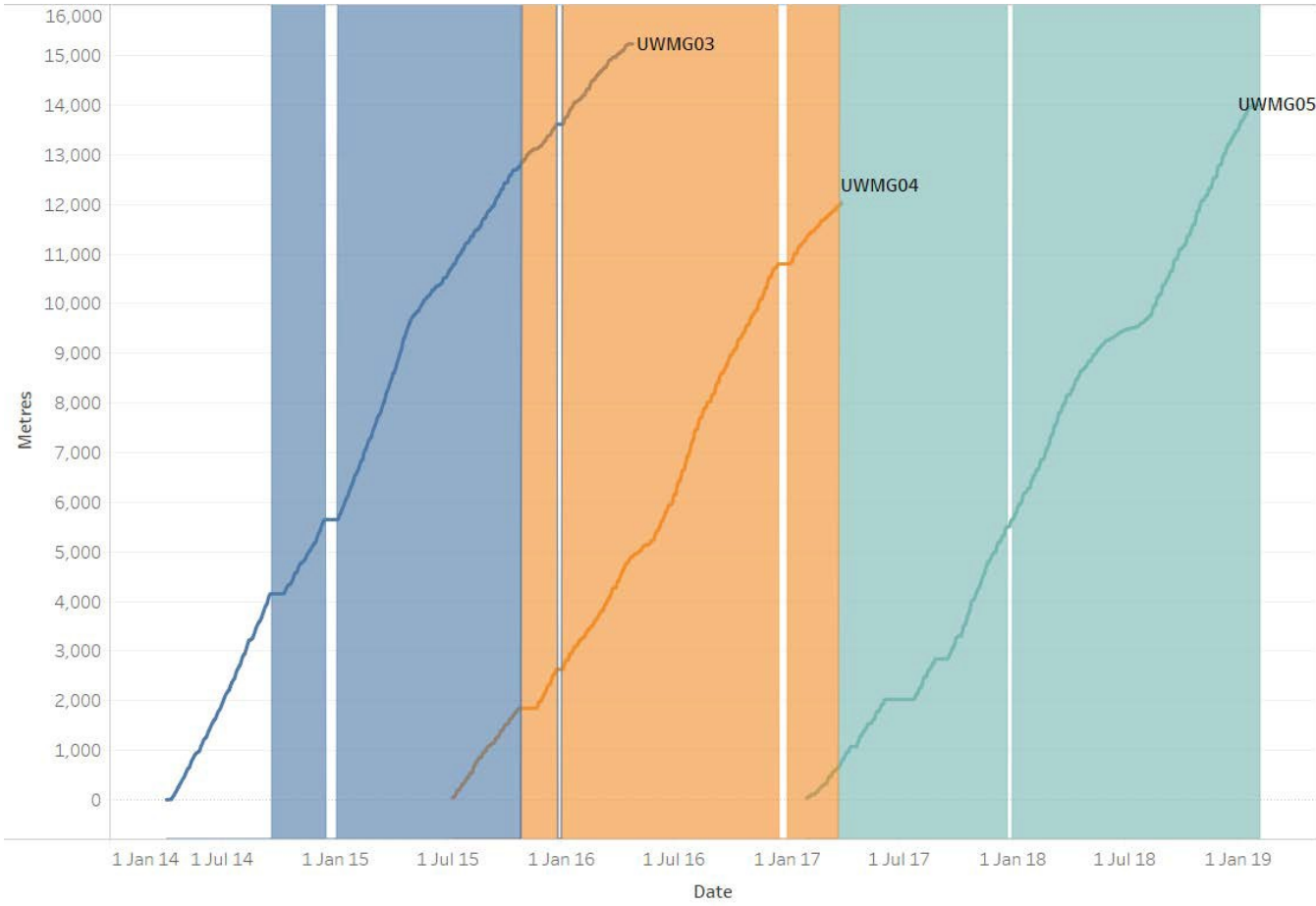
MG03 – 8,671m ≈ 28000ft

MG04 – 10,193m ≈ 34000ft

MG05 – 13,191m ≈ 44000ft

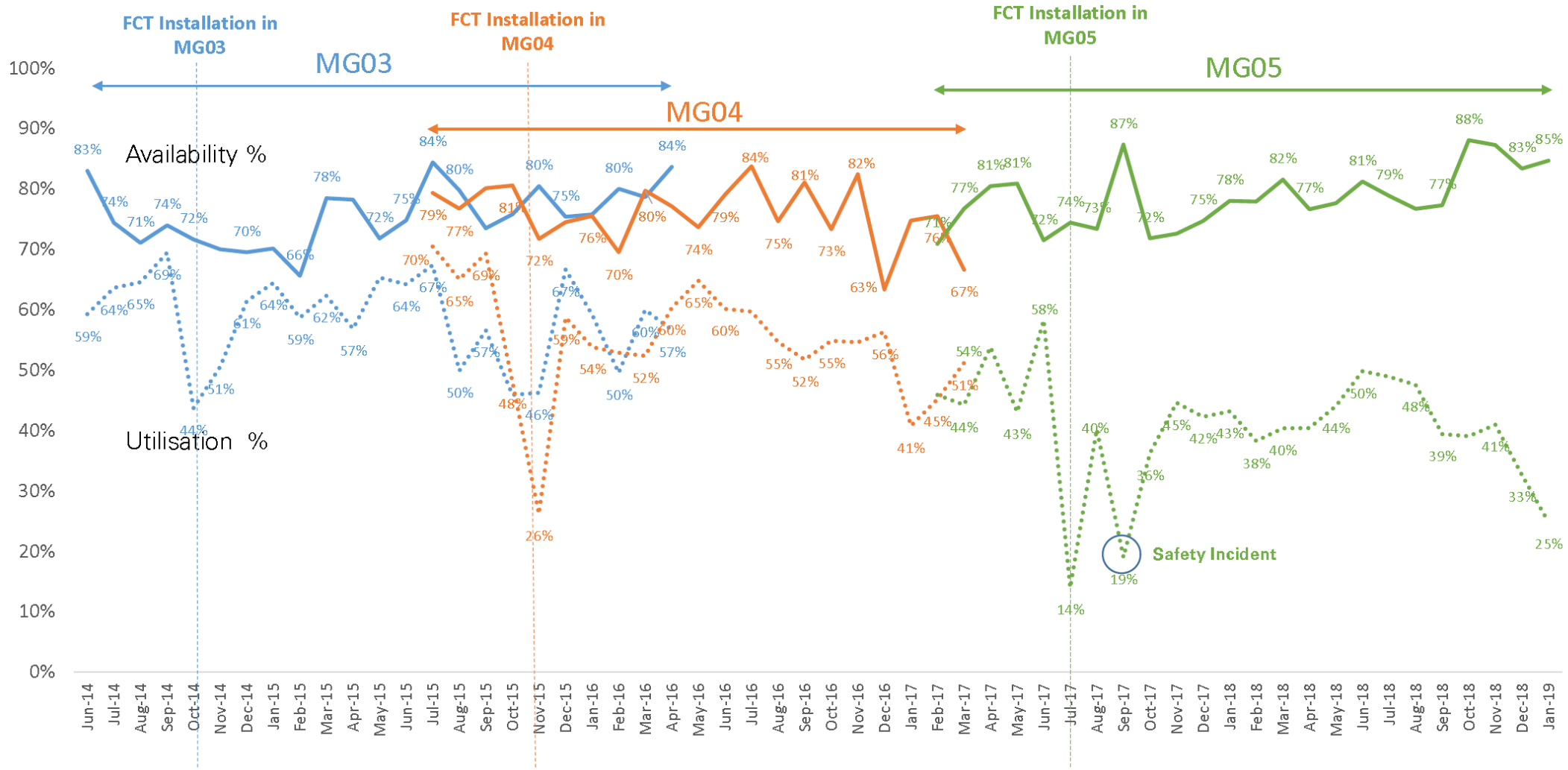
Data represents duration to cut total meters over 5 yr. period in three separate development units.

Data is inclusive of different roster patterns and strata conditions



4FCT Panel Performance – MG03, MG04, MG05

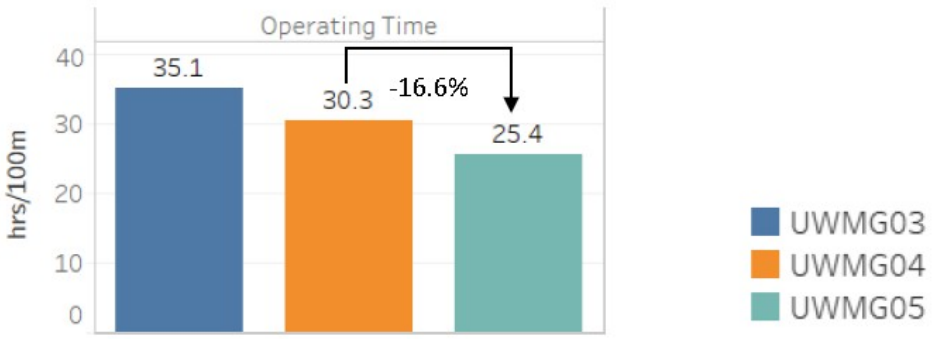
Utilisation and Availability

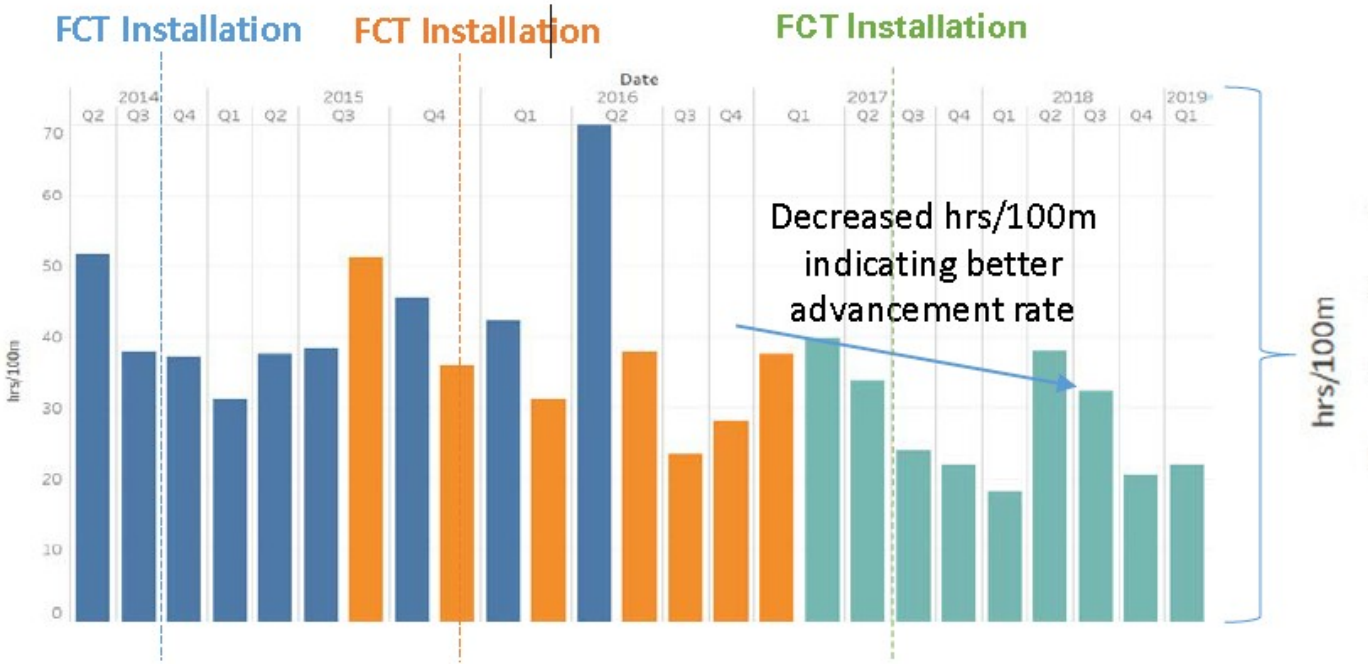


4FCT Panel Performance – MG03, MG04, MG05

Advance Rate Improvement

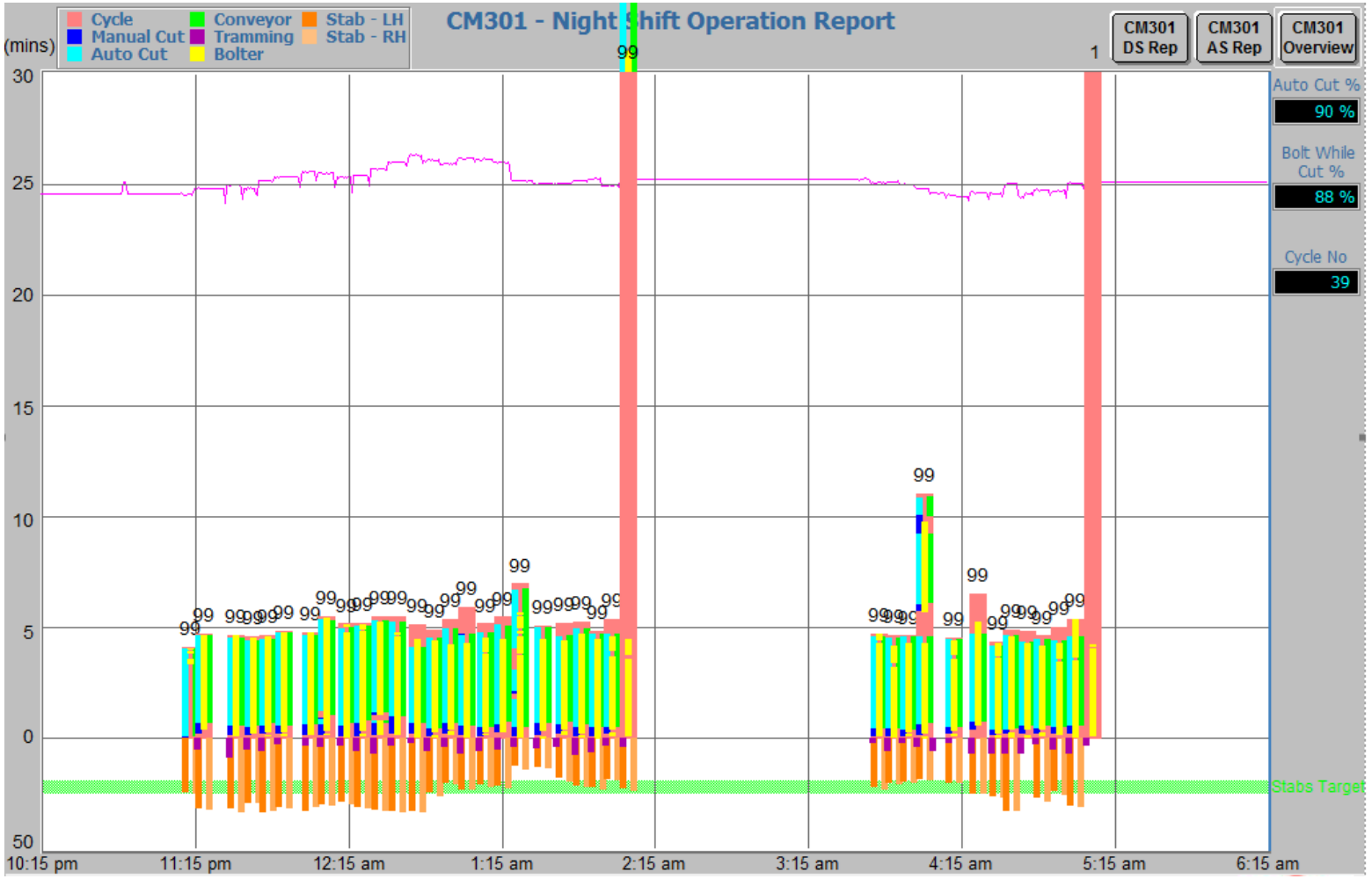
- The advancement rate had increased resulting in a 16.6% decrease in the in the number of op time required to develop 100m
- The improvement has a direct correlation with the introduction of the FCT and the MB650 removing the Bolting constraint of the previous configuration





4FCT Panel Performance – MG03, MG04, MG05

Cut rate – What Great Looks like



5 min cut and bolt cycles

Cut rate 12m/oh (40ft/oh)

System Records

41m shift

101m Day

1012m Month

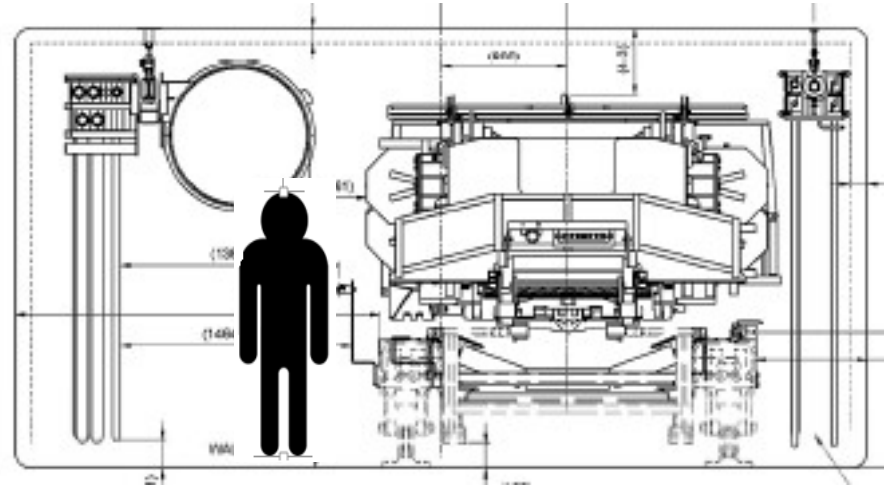
System Challenges

Key Learnings

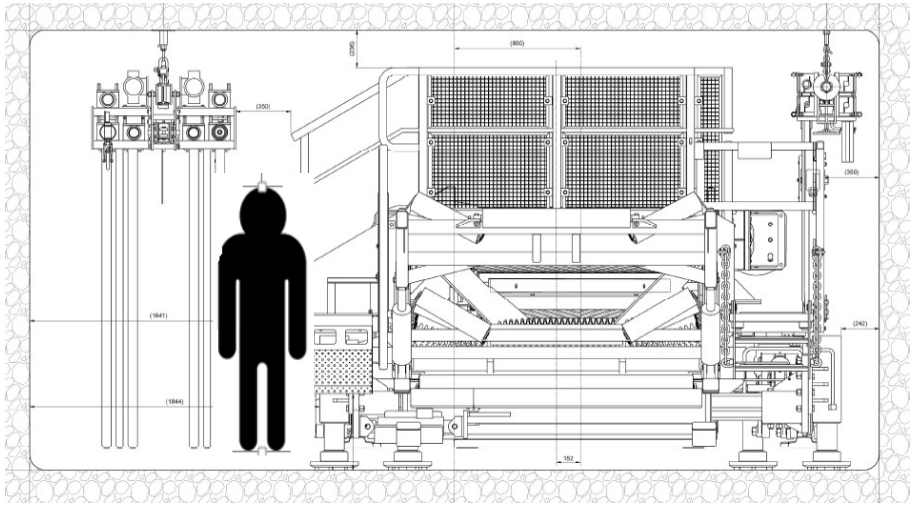
System challenges / Key learning's - Operational

Operational envelope considerations

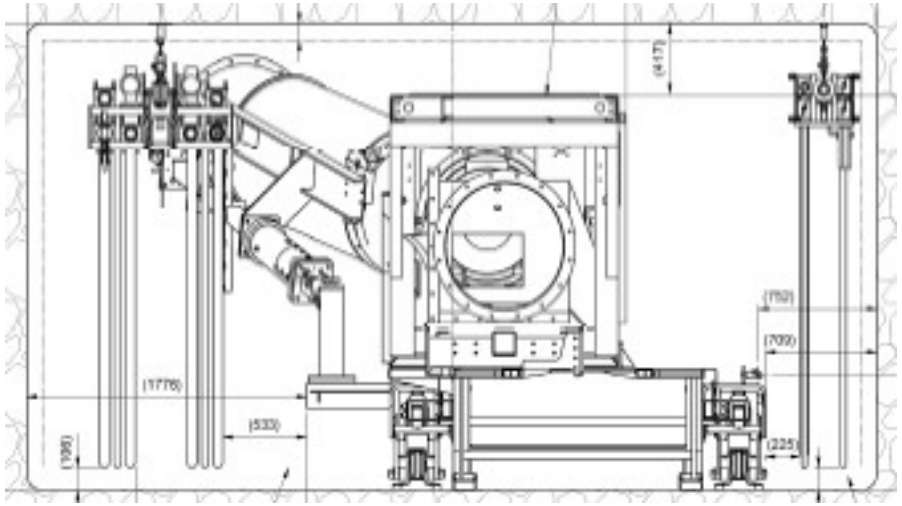
- Off line drivage effects with FCT/DMU/Monorail systems all in operational envelope
- System can tolerate 100mm of off line drivage
- DMU is 240m long and must be straight!!
- Monorail hanging bolt location is critical to ensure operation of trolleys



5.4m

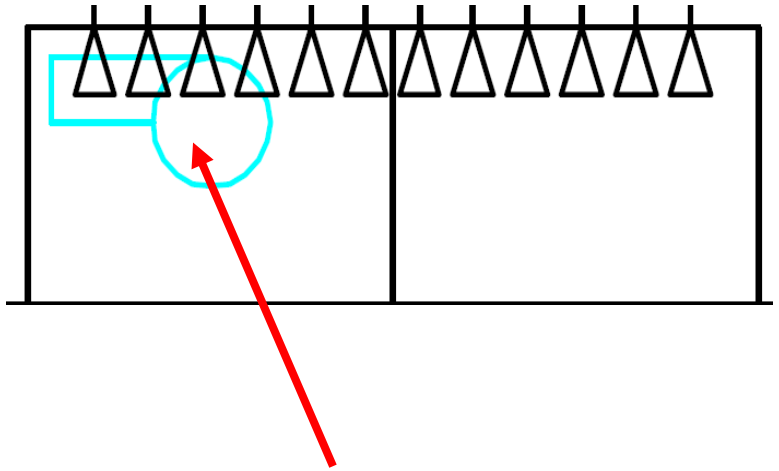


3.2m



Operational envelope considerations – caused by monorail implementation

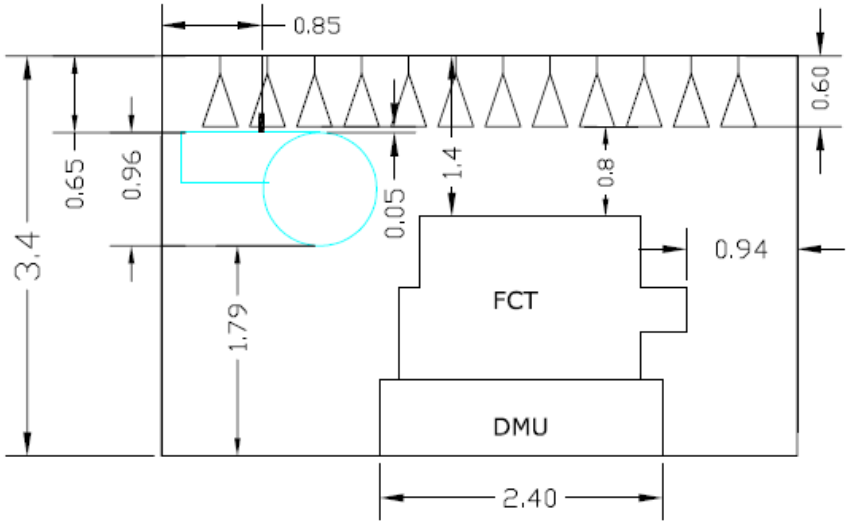
Mine explosion protection barrier (Bat Bags) requirements



Explosion barrier area effected by monorail systems

Monorail was lowered to accommodate current bat bag design requirements however the Cut height had to be increased to 3.4m to prevent interaction

A new Low height bat bag was developed in the long term to resolve this issue for site



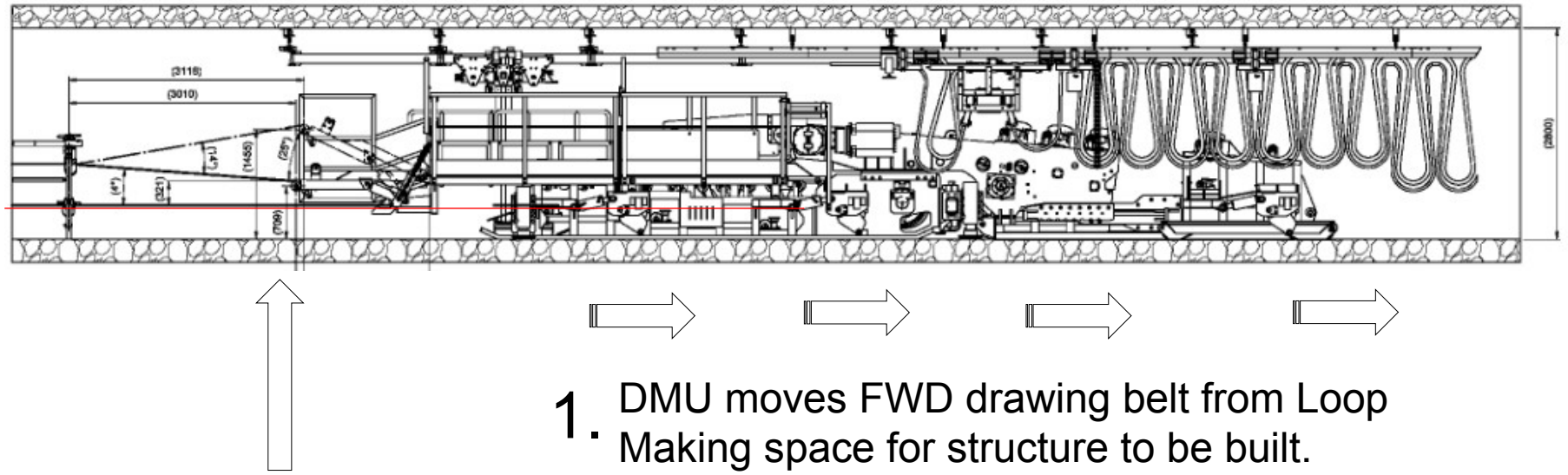
- Perceived complicated electrical and communication systems compared to conventional models
  - Leads to longer fault finding and increased skill requirements for trades
- Exposure to VVVF earth leakage issues due to the number of traction drives
  - OEM implemented developed drive stop system with the Joy VVVF Drive to remove the risk as part of implementation
- Mechanical Delays are more complicated and can have longer duration
  - Chain brakes
  - Traction issues
  - Hydraulic issues

Overall the system has experienced less maintenance delays since implementation an has improved as a result of improvements

Major Incident Learning

Bootend Failure During Advance MG05

Bootend Failure During Advance MG05

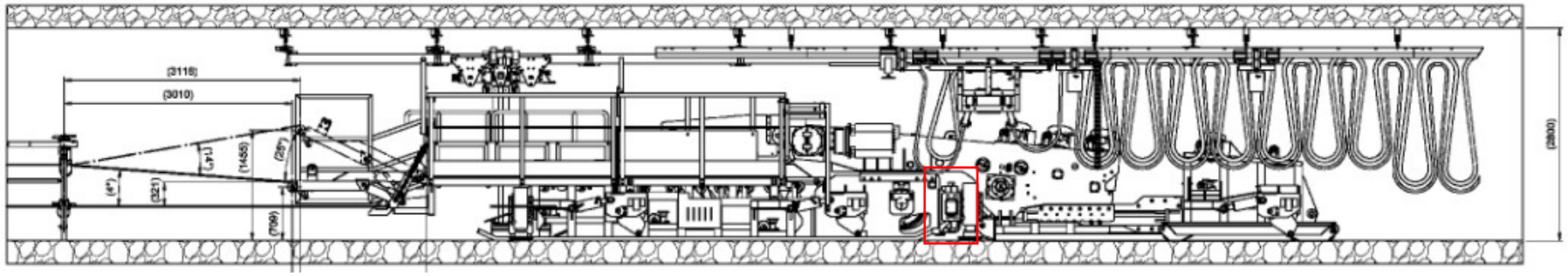


1. DMU moves FWD drawing belt from Loop
Making space for structure to be built.

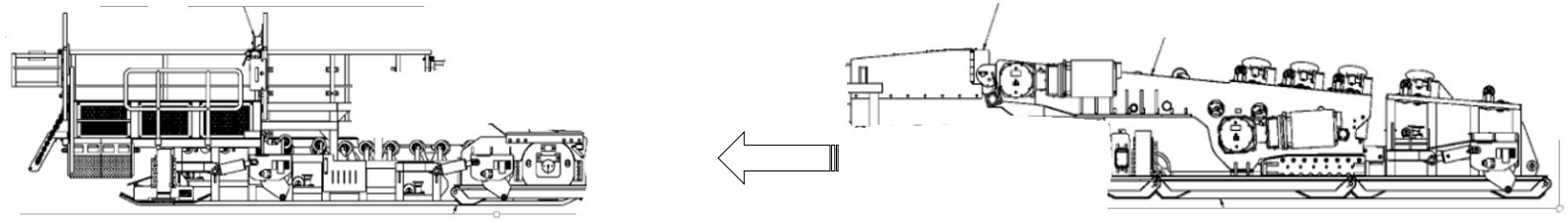
2. Belt structure is assembled
In belt “lifted area”
as DMU advances

Bootend Failure During Advance MG05

During the DMU Advance……



This connection point failed



The tail section moved out-bye approx. 18m.

Major Incident Learning

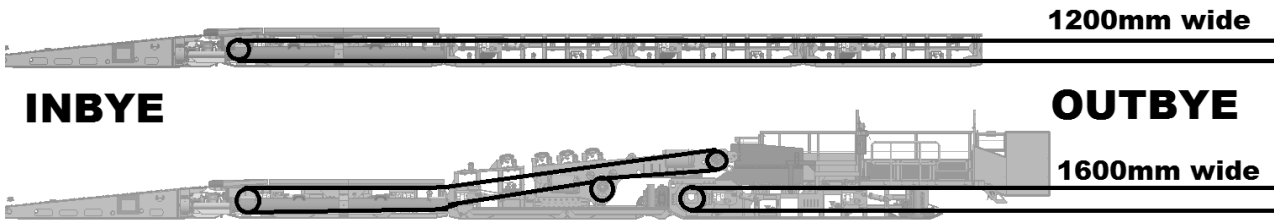
Bootend Failure During Advance MG05

The incident was investigated with the Regulator and the OEM

Key Causal Findings identified

- Mechanical design
- Parameter management
- Procedures and systems of work

Following investigation both Joy (OEM) and Ulan West Mine implemented the necessary redesign's, upgrades and procedural changes to ensure that the incident would not be repeated in the future



- Detailed report available on NSW resource regulators website https://www.resourcesregulator.nsw.gov.au/safety-and-health/incidents/investigation-reports

Summary

4FCT Panel Performance – MG03, MG04, MG05

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Summary

4FCT Panel Performance – MG03, MG04, MG05

Availability

- Availability of MG05 panel has increased consistently over time, up by 10% in 2019 as compared to 2017
- MG05 panel has experienced 19% less Planned Maintenance (PM) than MG04, and Unplanned Maintenance (UM) has reduced by 7%

Utilisation

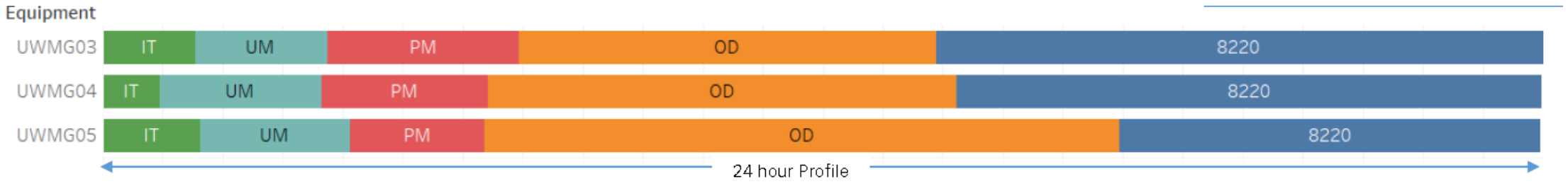
Utilization has been trending downwards over the last 3 yrs.

Result of the increase cut rate, the faster the unit moves forward the more supporting activity needs to occur in advancing with the machine

Productivity

16.6% reduction in operating hours required per 100 m development from MG04 to MG05

This uplift in productivity supports the improved cutting rate average over 5 moh



Summary

Was it all worth it?

Panel Type	A	B
Miner	MB650	MB650
Haulage	Shuttle Car	4FCT
Ventilation	Conventional	Monorail
Power	Conventional	Monorail
Budget Advance Rate	3.18 moh	4.6 moh

4FCT combined with the MB650 delivers a rate increase of 44%

Ulan West Mine is currently working towards implementing the system into the next development panel

INSERT VIDEO

Questions

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