
Improved LW Safety When Using PPD Control Systems

Todd Moore, General Manager of Safety – CONSOL Energy

Craig Dickerson, Assistant Superintendent Bailey Mine – CONSOL Energy

Paul Erdman, Controls & Automation Manager, Americas North – Komatsu Mining Corp

Longwall USA

May 21st 2019

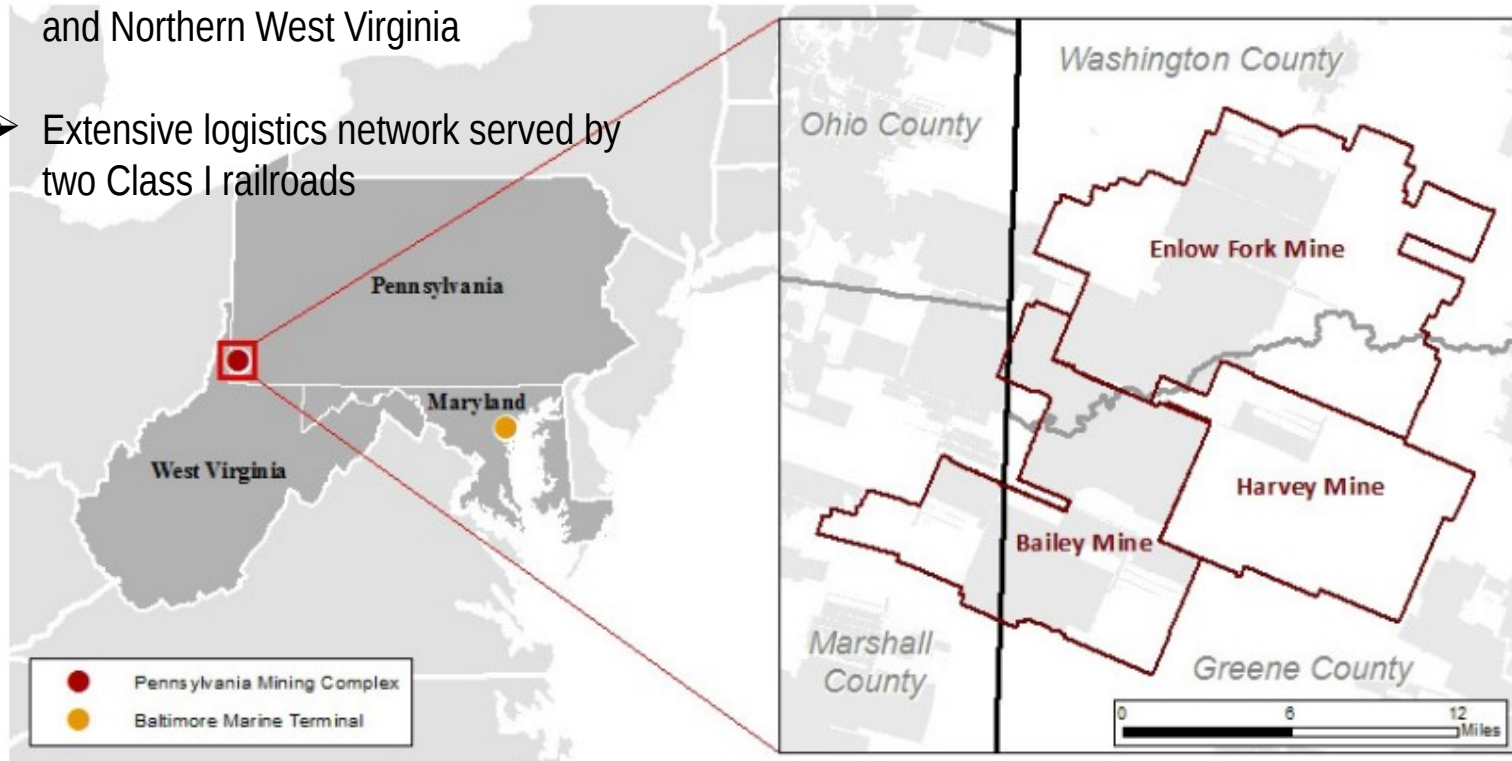


PAMC Mining Complex



PAMC Mining Complex

- Located in Southwestern Pennsylvania and Northern West Virginia
- Extensive logistics network served by two Class I railroads



PAMC Mining Complex



- Three highly productive, well-capitalized underground coal mines
- Five longwalls and 15-17 continuous miner sections
- Record production of 27.6 million tons in 2018
- Largest central preparation plant in the United States

CONSOL Marine Terminal



Personal Proximity Detection Systems Overview

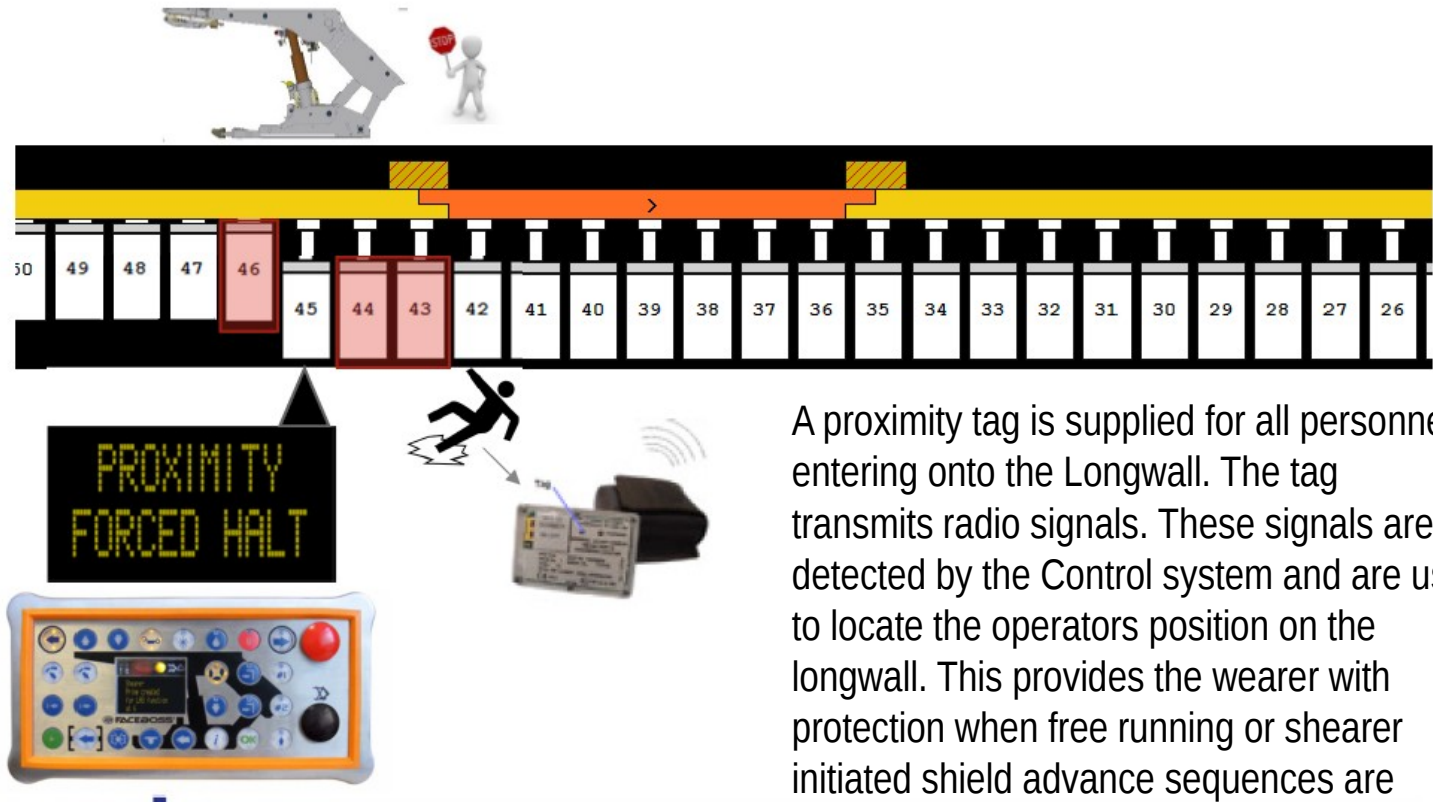
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Personal Proximity Detection

[Click here to view the video](#)

Personal Proximity Detection



A proximity tag is supplied for all personnel entering onto the Longwall. The tag transmits radio signals. These signals are detected by the Control system and are used to locate the operators position on the longwall. This provides the wearer with protection when free running or shearer initiated shield advance sequences are running.

Personal Proximity Detection

Proximity protection gives the mine the reassurance that if an operator is detected within the Halt Zone of an **Automated** advancing shield, the shield will be halted.

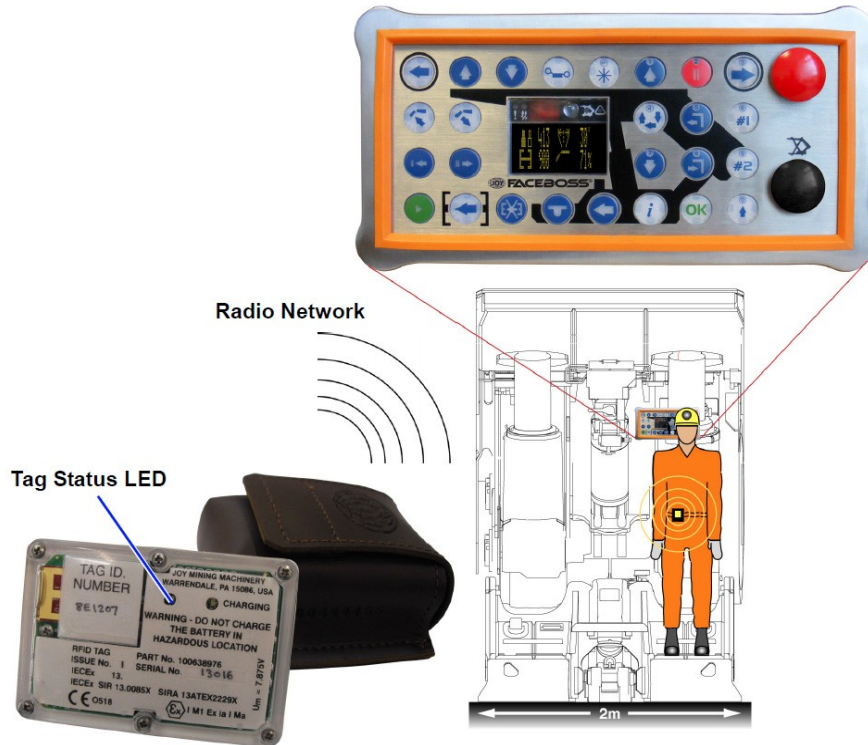
The Faceboss feature already allows operators to pause and unpauses to allow them to safely pass a hazardous area.

Any detection of a Tag and its movement across the Longwall and along the Stageloader/Tailpiece areas will be visible from the Headgate Display.

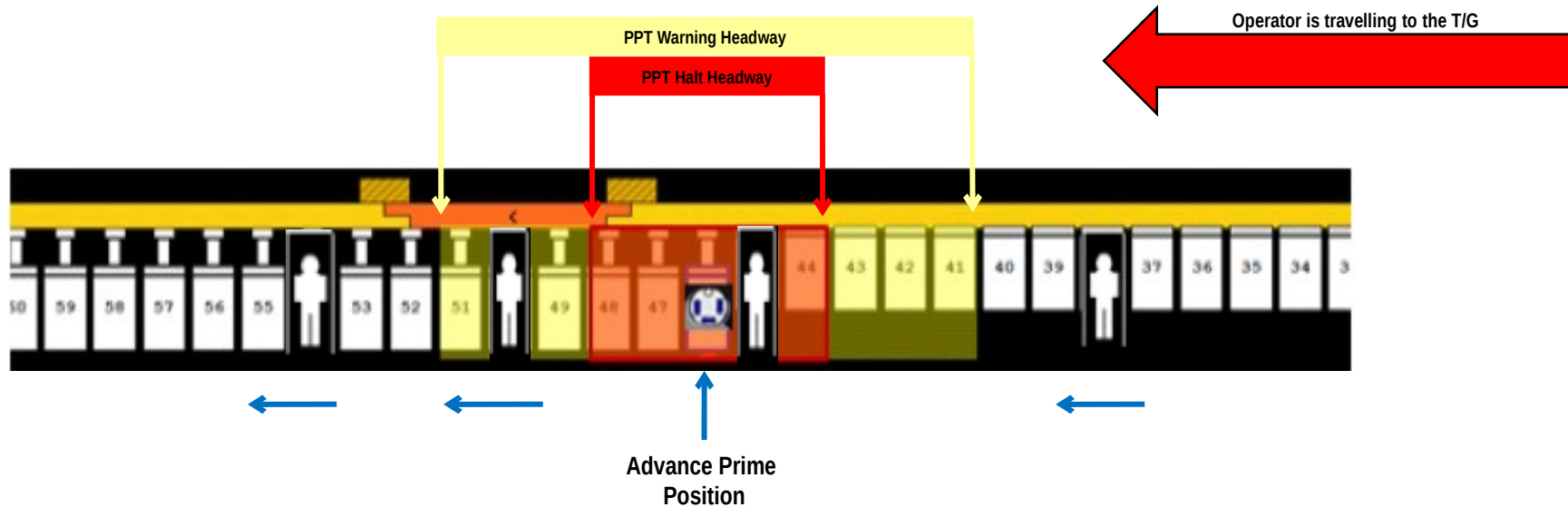


Hardware Information

- Proximity Tag
 - Has a 2.4GHz radio transceiver
 - Rechargeable 2200mAh Li-Ion battery.
 - Fully potted in a polycarbonate box.
- PRS and Headgate area RS20s Mimics
 - Also have an integrated radio transceiver.
 - Uses the same 2.4GHz radio link as the tags.
 - Utilizes relative RF received signal strength and quality of service algorithms to accurately locate the operators position.



Personal Proximity Detection Operation



Personal Proximity Detection Surface Station

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Surface Station

- A surface station consists of a RS20s Mimic and Micro. The system will be connected to a computer.
- The Mimic, Micro, and software is the same as is running underground on the longwall.
- Surface Test Station provides the following:
 - Reassurance to the wearer that their tag is healthy prior to going underground.
 - Any deficiencies found with the hardware, battery life, software version or boot up time will be identified.



Surface Registration

- The operator will take their Tag from the charging station and walk into a designated test zone.
- Once in the zone the Tag status and information will be displayed on the screen.
- The Tag is intelligent, therefore all information is stored on the Tag and uploaded to the system underground when the operator enters the longwall.

The screenshot displays the 'JOY Proximity Tag Surface Test' interface. The top bar shows the date '08 Apr 2016' and time '14:43:32'. The main display is split into two sections: 'Healthy Tags' (left, marked with a green checkmark) and 'Un-healthy Tags' (right, marked with a red X). The 'Healthy Tags' section lists Operator4, Operator3, and Operator2. The 'Un-healthy Tags' section lists Operator1. Below the main display is a table with columns: Tag ID, Name, Role, Battery %, Software, and Status. A red arrow points to the 'Operator1' row in the table, which is highlighted in red. The bottom of the screen features a navigation bar with icons for user management, diagnostics, and other functions.

Healthy Tags displayed here

Un-healthy Tags displayed here

Detailed information of Tag:

Tag ID	Name	Role	Battery %	Software	Status
1AA182F	Operator4	Staff	100	P144-05-06	✓
1AA1E0F	Operator3	Visitor	99	P144-05-06	✓
1AA182F	Operator1	Production Operator	3	P144-05-06	X
1AA302F	Operator2	Shearer Driver	57	P144-05-06	✓

1. Name
2. Tag ID
3. Role
4. Battery Level
5. Software
6. Status

Personal Proximity Detection Underground Operation

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Underground Operation

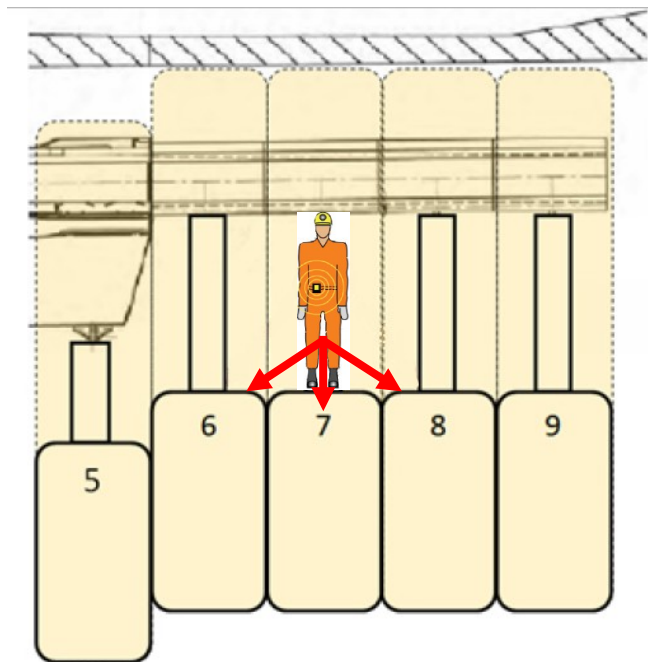
Operator Position Accuracy

The operators Tag location is accurate to +/- 1 shield of the operator's physical positioning.

No two longwalls are the same, the subtle variations of each longwall need to be taken into consideration.

Some of the factors that we need to consider are.

- Front Walkway or Front and Rear Walkway.
- Mimic placement, canopy mounted, leg mounted, H/G or T/G side leg or leg pocket.



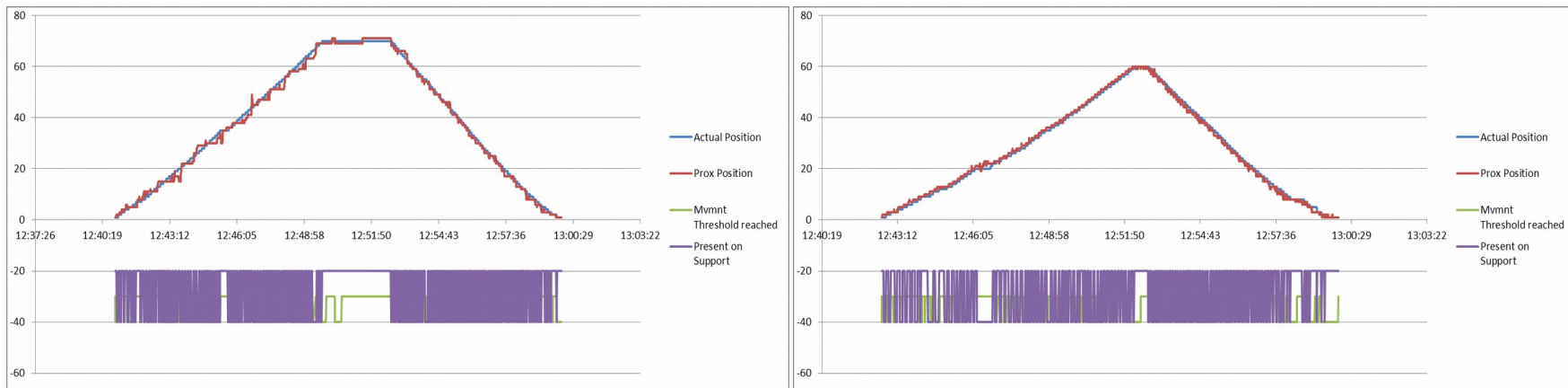
The operator's physical position is Shield 7 however the operators reported Tag location could be either Shield 6, 7 or 8.

Underground Commissioning Checks

Before the personal proximity detection system can be fully deployed KMC will perform commissioning checks. These tests involve wearing the proximity tags and performing a series of face walks.

As part of the face walk process specific buttons on each Mimic along the face are pressed. We log the button presses to create a time stamp that correlates to the position of the reported tag.

Information gathered during these checks is extracted and analysed. Post analysis of the data allows us to optimise certain operational parameters to fine tune the performance.

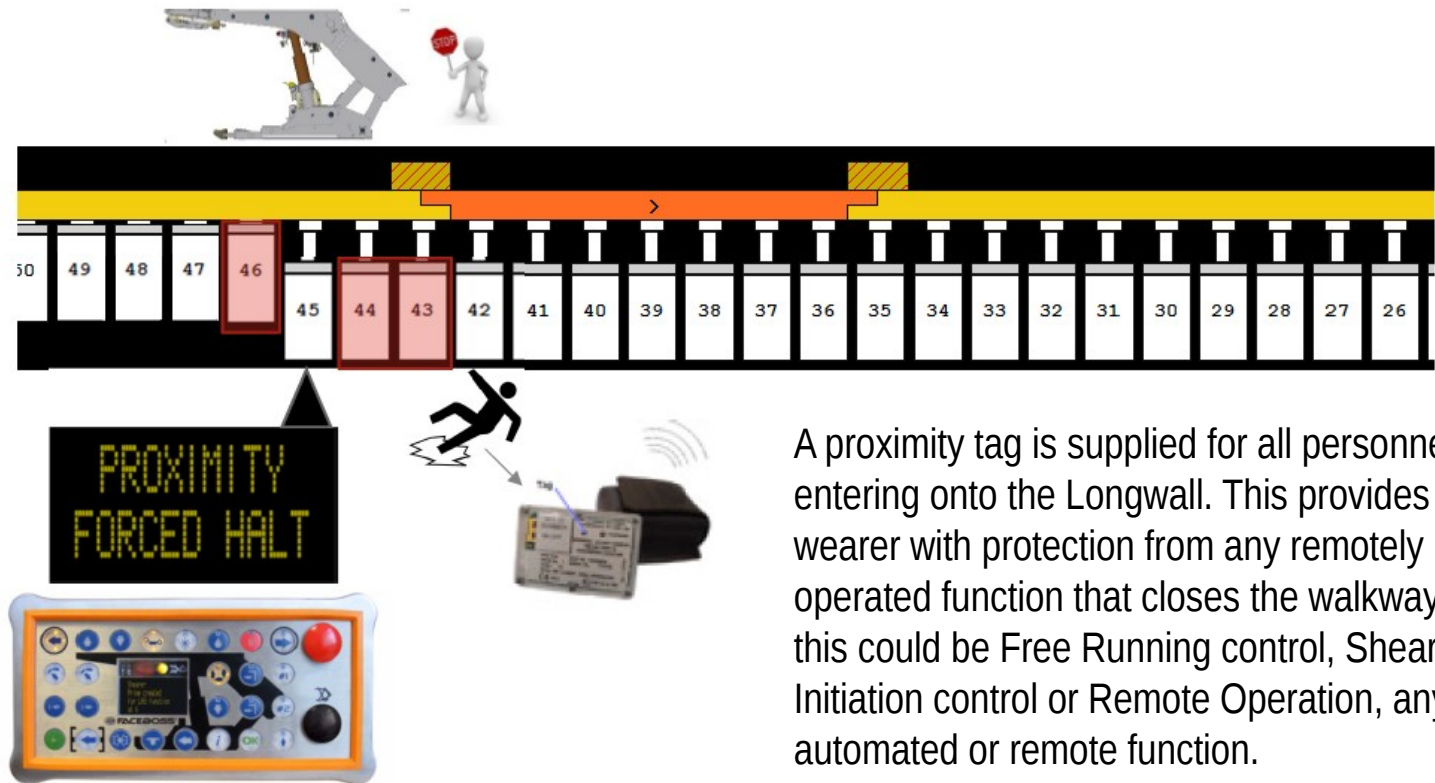


Underground Operation

- The PPD Tag should be registered when entering onto the face, this provides the following:
 - Confirmation that their Tag is charged, and their Tag is in full working order.
 - If you do not register, the system will constantly remind you to register.
 - Whether registered or not you will always be protected by the system.
 - The registration information will be recorded on the RS20s system
- One Touch registration 'OK' button:
 - When an operator walks on to the face, the RS20s Mimic that has detected their position will prompt the operator to register their proximity Tag by a beep. In this example Tag '1AA64F7' is being asked to register their tag.

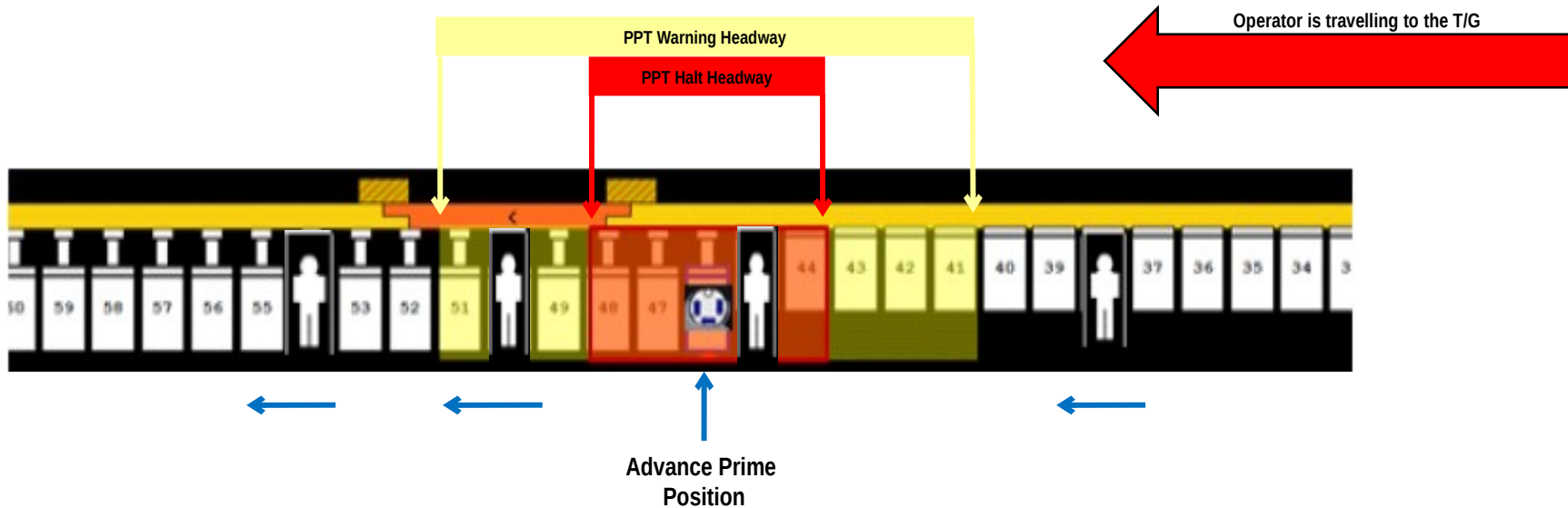


Underground Operation



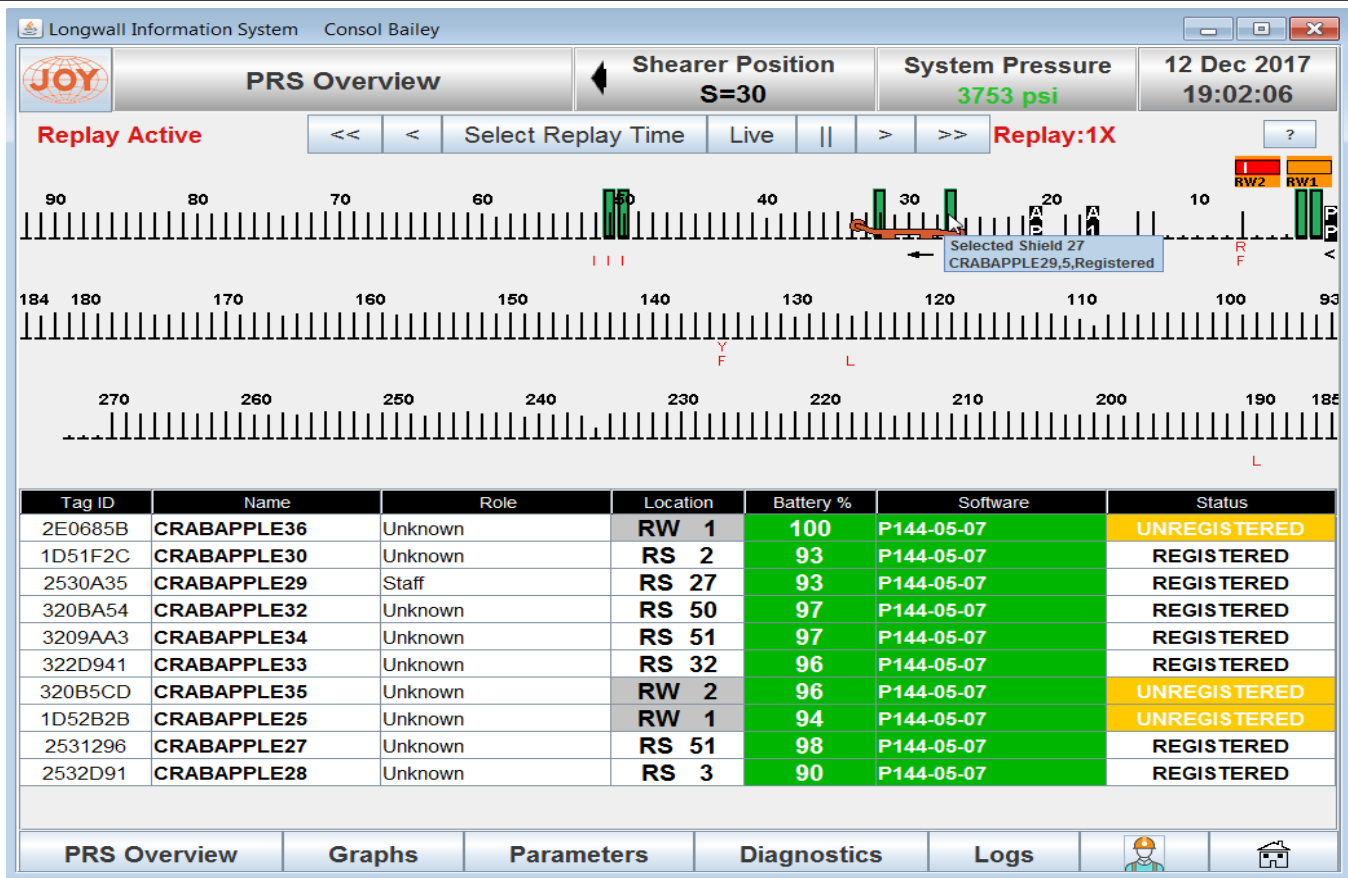
A proximity tag is supplied for all personnel entering onto the Longwall. This provides the wearer with protection from any remotely operated function that closes the walkway, this could be Free Running control, Shearer Initiation control or Remote Operation, any automated or remote function.

Personal Proximity Detection Operation



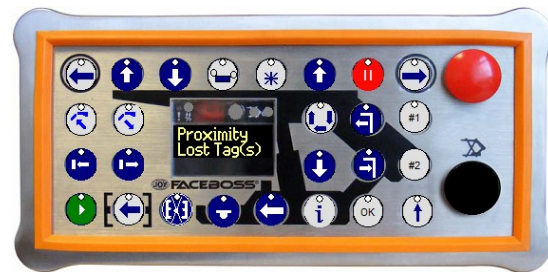
PPD Warning Headway Towards	5
PPD Warning Headway Away	5
PPD Halt Headway Towards	2
PPD Halt Headway Away	1

Longwall Information System (LIS)



Tag Health Monitoring

- Lost Tags:
 - Registered Tags will be continually monitored by the control system. If the control system fails to receive healthy communications for more than 4 seconds a 'Lost Tag' alarm will be generated.
 - A facewide alarm will be generated and Advance primes will be halted until the tag is re-found or the 'lost tag' is acknowledged and the alarm is cleared down.
- Battery Voltage:
 - A fully charged battery will last for more than 24 hours.
 - Each tag is constantly measuring its voltage and transmits this data to the control system.
 - If the battery life is below 20% (approx. 3.5hrs battery life) a 'Battery Low' message will be displayed for 5 seconds and repeated every 30 mins
 - If the battery life is detected below 5% (approx. 30mins battery life) a 'Battery Critical' message will be displayed for 5 seconds and repeated every 5 mins



Underground Operation De-Registration

De-Registration is required to inform the control system when an operator is leaving the longwall area. This helps to detect when tags are being genuinely lost from the face area and to take appropriate action.

There are two ways to De-Register:

Auto De-Registration:

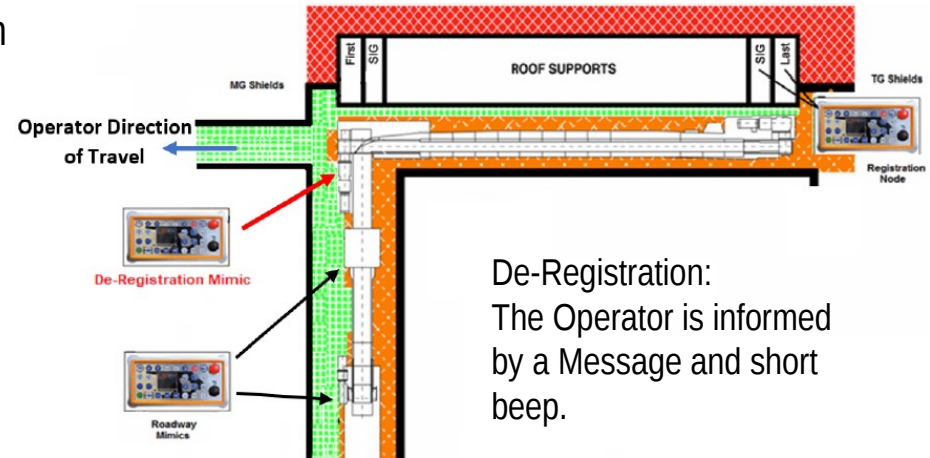
Registered Tags are automatically de-registered when operator walks passed a designated de-registration Mimic.

Manual De-registration:

Registered Tags are manually de-registered by using the '#2' button and then pressing 'OK' to confirm.



Figure 29: De-Registration at Cut Through



Personal Proximity Detection Questions

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