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Engineering Safety
Advancing Automation

Safer Mining Technologies Session

New Proximity Detection Technology

Longwall USA 2013

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General Overview

Proximity Detection, when deployed correctly, can help save lives and reduce lost-time accidents – with little or no loss in mine productivity.

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IntelliZone
PROXIMITY DETECTION

Prox Technology Timeline

2005
M3-1000 System Development

2006 - 2008
Mine Testing
Pre-production Deployments

2009 – 2011 Installs (Matrix & Joy)
50 CMs Operational
6 Companies, 19 mines

2012
IntelliZone System Development

2012 – Present Installs (Matrix & Joy)
150+ CMs Operational
10+ Customers
34 mines

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Proximity System Comparison

Gen 1: M3-1000	Gen 2: IntelliZone
• Designed for CMs	• Designed for full section
• Fixed sensing range for slow moving equipment (6 drivers). Approx. 35 ft.	• 3x+ increased sensing range, designed for slow and fast moving (4 Drivers)
• Limited SharpZone technology	• Full SharpZone technology
• Robust, mine-proven construction	• Robust, mine-proven construction
• Marketed by Matrix as M3-1000	• Marketed by Matrix as IntelliZone
• Marketed by Joy as SMARTZONE	• Marketed by Joy as SMARTZONE (Gen 2)

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General Overview

Components:

- Drivers installed on machine
- Locator on miner, in CM remote, or in another vehicle

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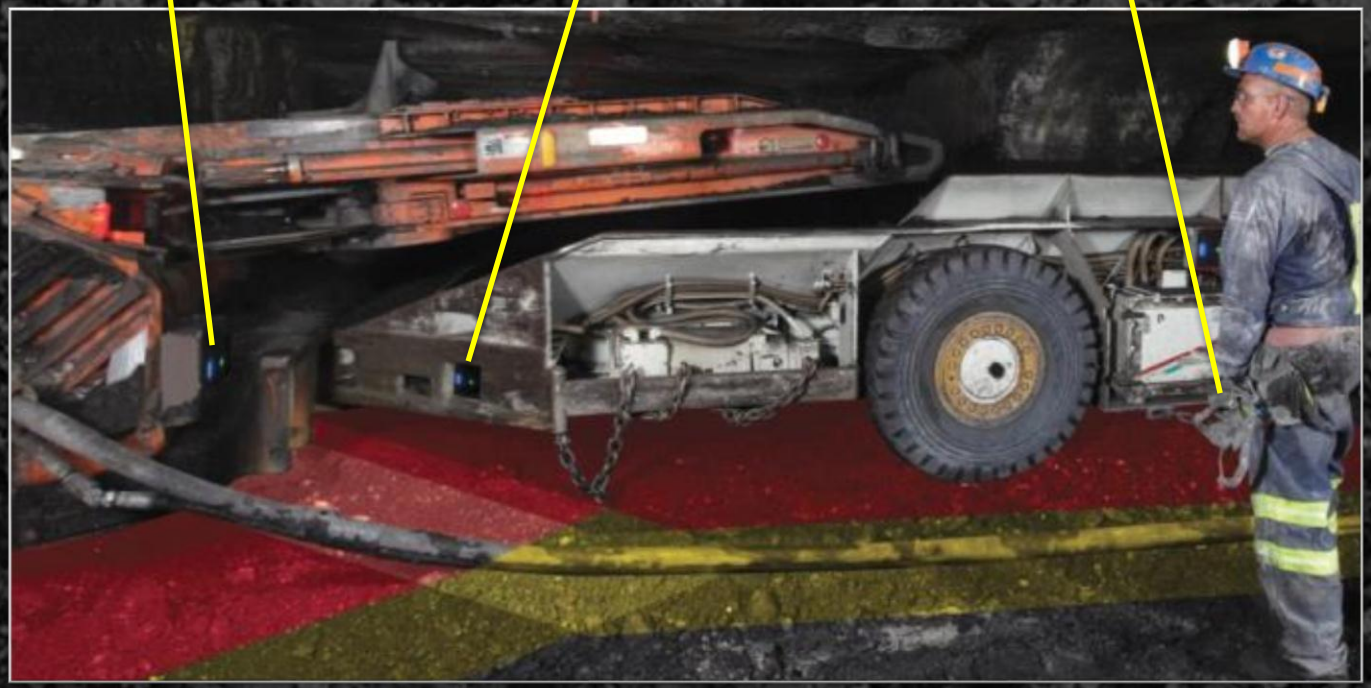
IntelliZone
PROXIMITY DETECTION

IntelliZone™ (Gen 2)



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IntelliZone
PROXIMITY DETECTION

IntelliZone Driver

Drivers (4 per vehicle)

- Smaller than M3-1000 receivers
- Machine-mounted near corners
- Polycarbonate enclosure with potted-XP electronics inside

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IntelliZone
PROXIMITY DETECTION

IntelliZone Driver

Drivers (4 per vehicle)

- Smaller than M3-1000 receivers
- Machine-mounted near corners
- Polycarbonate enclosure with potted-XP electronics inside

- Small diameter cable
- Adapter for existing pockets available
- Permissible

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PROXIMITY DETECTION

IntelliZone Locator

Locator or Personal Wearable Device (PWD)

- Cell phone sized
- 18 Hour Rechargeable Battery
- Audible & Visual Alerts
- Auto-Test on Surface Prior to Underground Use
- Intrinsically Safe Version for Coal Mines

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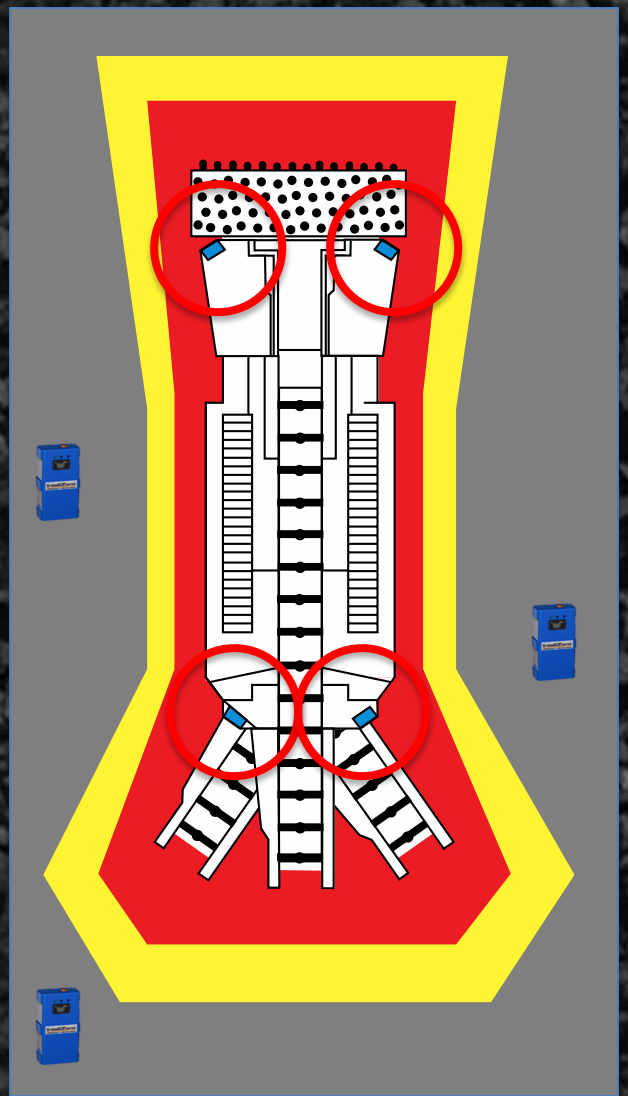
General Overview

Awareness Zones

- Drivers on machine emit spread-spectrum electromagnetics
- Advanced software algorithms provide (X,Y) location of personnel & vehicles around machine, and allow generation of multiple, “shaped” zones (SharpZone Technology)



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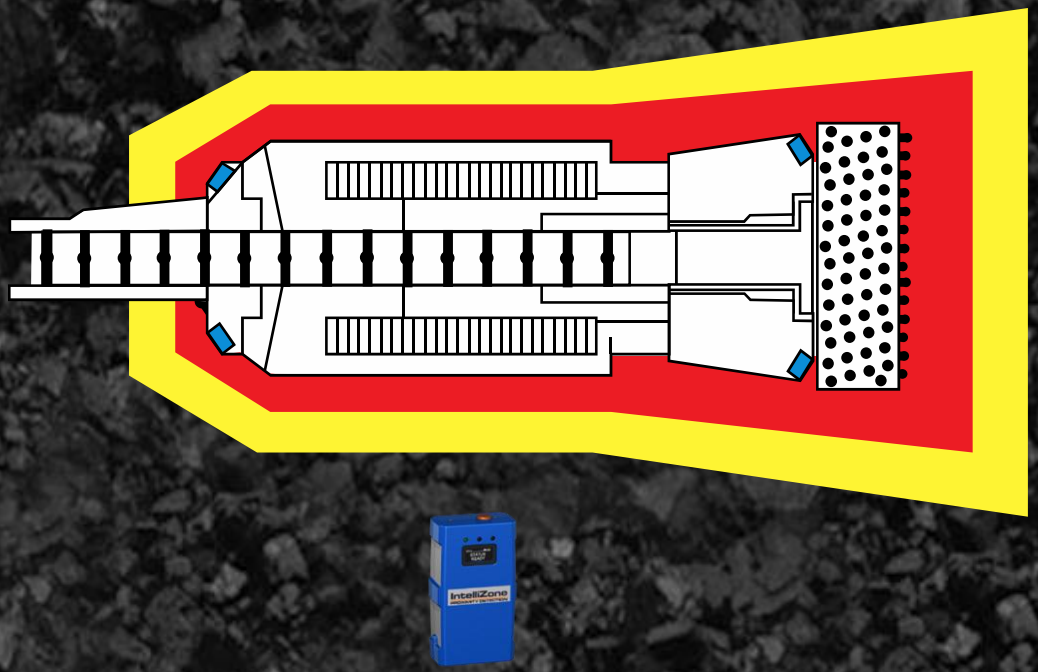
IntelliZone
PROXIMITY DETECTION

IntelliZone Technology

- **SharpZone Technology Creates:**
  - Precise Zone Shapes
  - Safe, Efficient Zones



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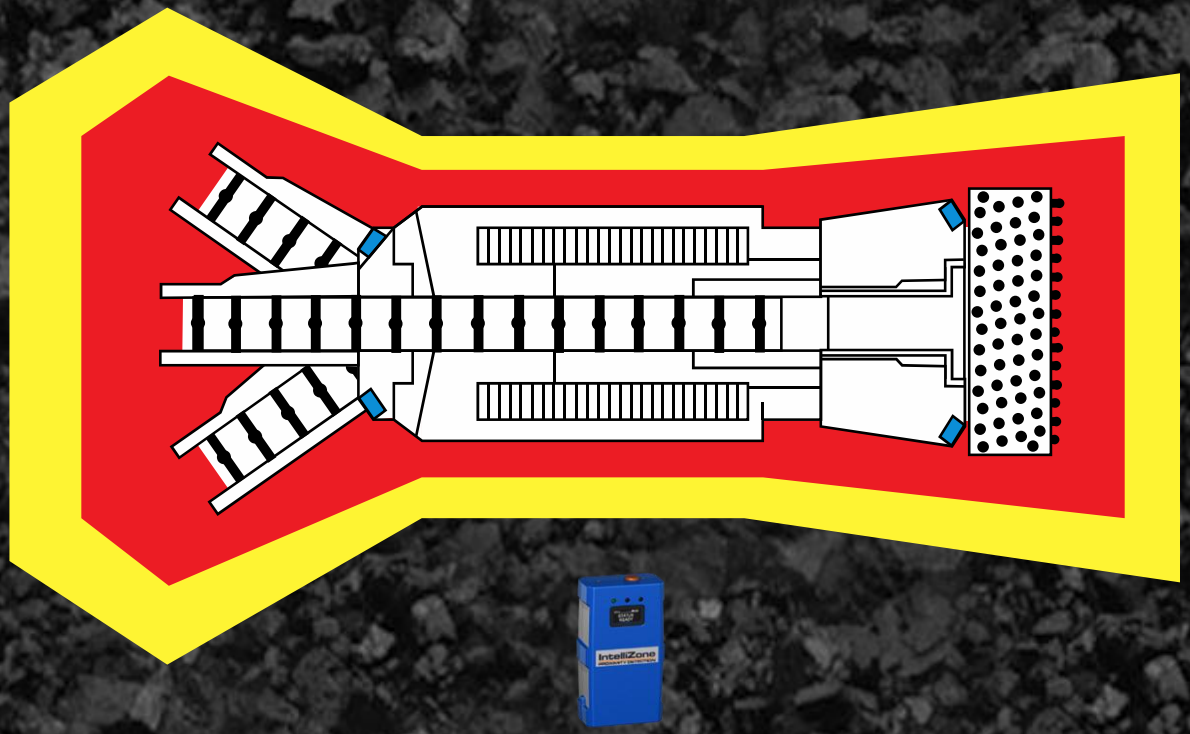
IntelliZone
PROXIMITY DETECTION

IntelliZone Technology

- **SharpZone Technology Creates:**
  - Automatically reshapes zones



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IntelliZone
PROXIMITY DETECTION

IntelliZone Technology

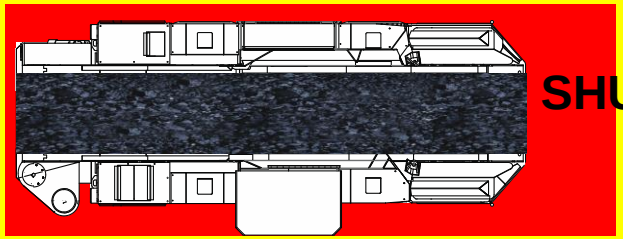
- **SharpZone Technology**

  Modifies zones based on a variety of programmable inputs, including

  - Speed
  - Direction
  - Pivot
  - Steering

Low Speed Zones

CAUTION Zone



SHUTDOWN Zone

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IntelliZone
PROXIMITY DETECTION

IntelliZone Technology

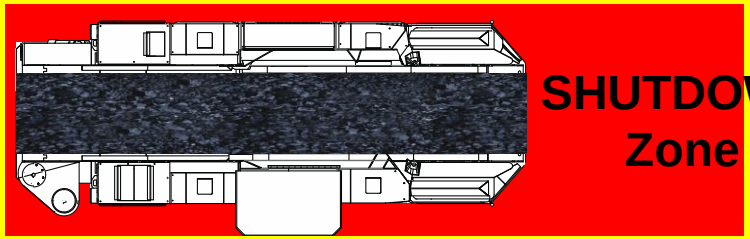
- **SharpZone Technology**

  Modifies zones based on a variety of programmable inputs, including

  - Speed
  - Direction
  - Pivot
  - Steering

Medium Speed Zones

CAUTION Zone



SHUTDOWN Zone

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IntelliZone
PROXIMITY DETECTION

IntelliZone Technology

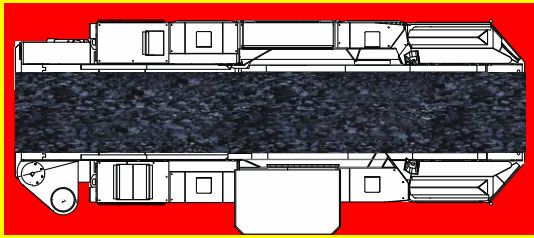
- **SharpZone Technology**

  Modifies zones based on a variety of programmable inputs, including

  - Speed
  - Direction
  - Pivot
  - Steering

High Speed Zones

CAUTION Zone



SHUTDOWN Zone

"Sees" Through Plastic Barriers

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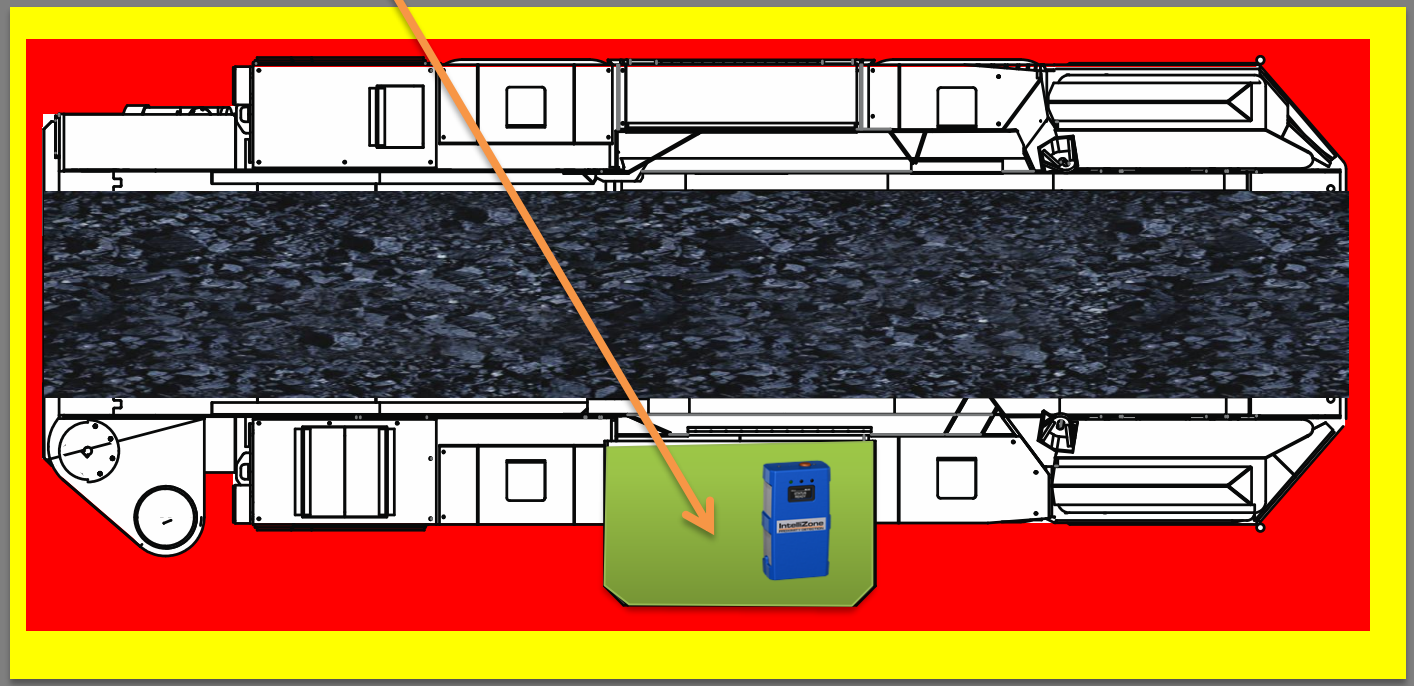
PROXIMITY DETECTION

IntelliZone Technology

- **SharpZone Technology**

  Creates “Neutral Zones” within Awareness Zones

Shuttle Car
Cab
Green Zone



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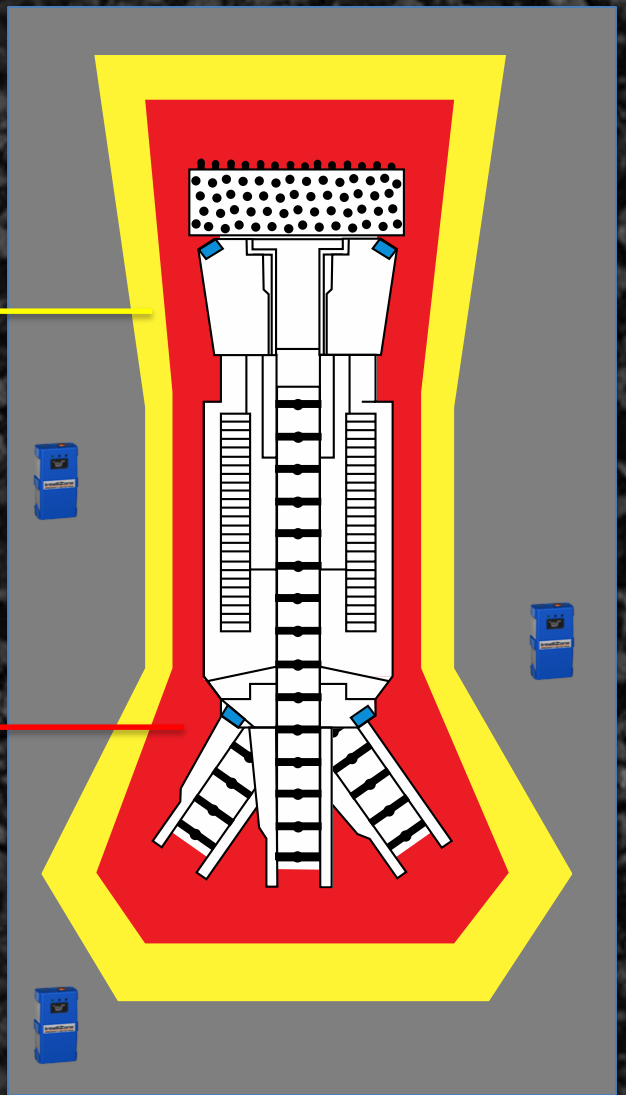
General Overview

Zone Types

CAUTION Zone

SHUT DOWN Zone



System Warnings

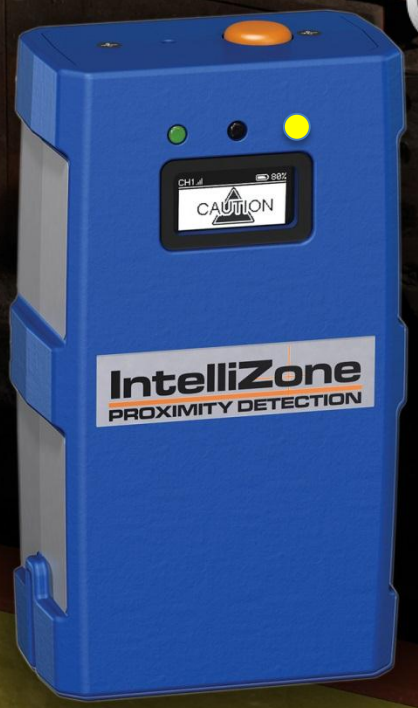
Normal Operation

- Driver: Green Light
- Locator: Green Light
- Equipment: Normal Operation

System Warnings

CAUTION Zone

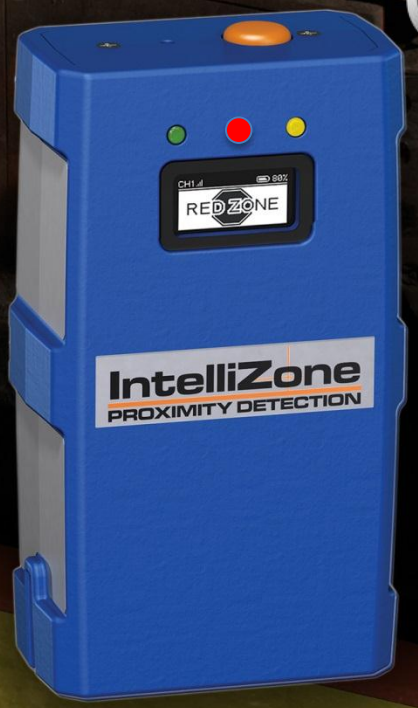
- Driver: Flashing Yellow Light
- Locator: Flashing Yellow Light & Audible Warning
- Equipment: Auto-Slows



System Warnings

SHUT DOWN Zone

- Driver: Flashing RED Light
- Locator: Flashing RED Light & Audible Warning
- Equipment: Auto-Stop



SMARTZONE Proximity Detection

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PROXIMITY DETECTION

Keys to Proximity Detection Success in Your Mine

Proper installation & system protection during CM manufacture or rebuild is key to reliable operation

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Keys to Proximity Detection Success in Your Mine

- Guard equipment & cabling as aggressively as possible, but plan for replacement
- Shape zones to vehicles and mine conditions for most efficient & safe interaction
- Use small-diameter cables

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Keys to Proximity Detection Success in Your Mine

- Use common systems & components across all equipment & universal Locator
- Make sure management communicates with miners that system **must be used & maintained**

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PROXIMITY DETECTION

Keys to Proximity Detection Success in Your Mine

- Conduct Post-installation training on how to interact with Prox system efficiently (operators & section personnel)
- Conduct Post-installation training on how to maintain the system (maintenance personnel)

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Production Experience – Operator Perspective

- Have on-site ‘Experts’ for day-to-day issues (Mine Personnel)
- Plan ahead for spare parts & local service – have at Mines AND Equipment Vendors

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Production Experience – Operator Perspective

- Re-training classes at mine for all shifts.
  - Conducted by Matrix
  - Scheduled annually or on emergency basis

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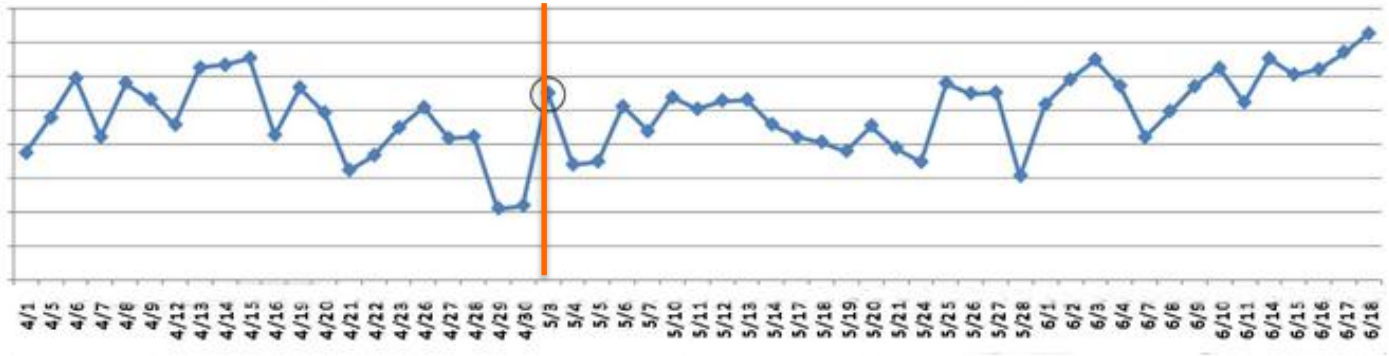
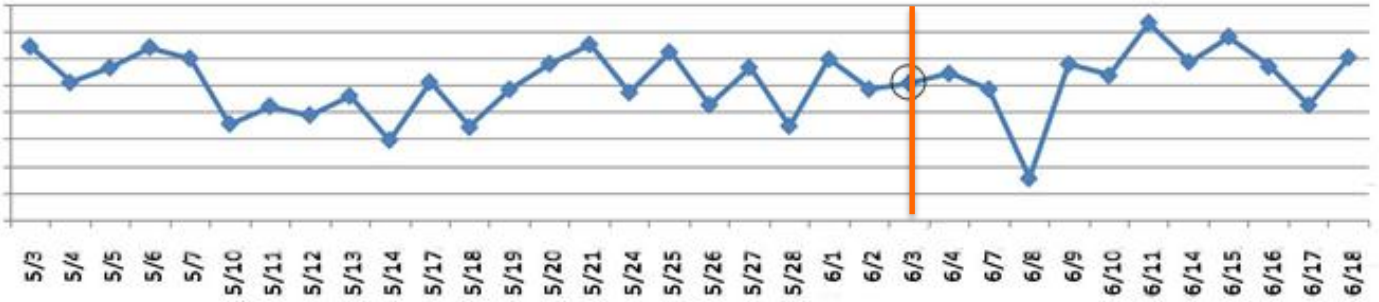
PROXIMITY DETECTION

Production Experience

UNIT 1 COAL PRODUCTION



UNIT 5 COAL PRODUCTION



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PROXIMITY DETECTION

Safety Impact

"Proximity systems increase operator awareness of the red zone, and are a useful training tool to reinforce safe operating habits."

"To date, on CM mining sections where proximity has been installed, there have been no red zone accidents or reported near-misses."

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PROXIMITY DETECTION

Non-IS Proximity Detection – *IntelliZoneHD & LT*

Surface and Hard Rock Prox

- Machine-to-Machine with In-Cab Alerting
- Machine-to-Person
- Collision Detection – including Equipment Control

Mine Tested. Miner Approved.

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