Open-cut Proximity Detection
&
Underground Collision Avoidance

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Overview

1. What are these two technologies
2. The case for change
3. Peabody trial and learning's
   - SafeMINE
   - Surface CAS System
4. UG proximity detection
5. History + working group
   - Two significant stall points
   - Current trials
   - Thermal imaging
6. Future state and issues

CASE FOR CHANGE – Open-cut

1. Fatalities in Australia
2. Near misses within Peabody AU
3. Equipment damage costs

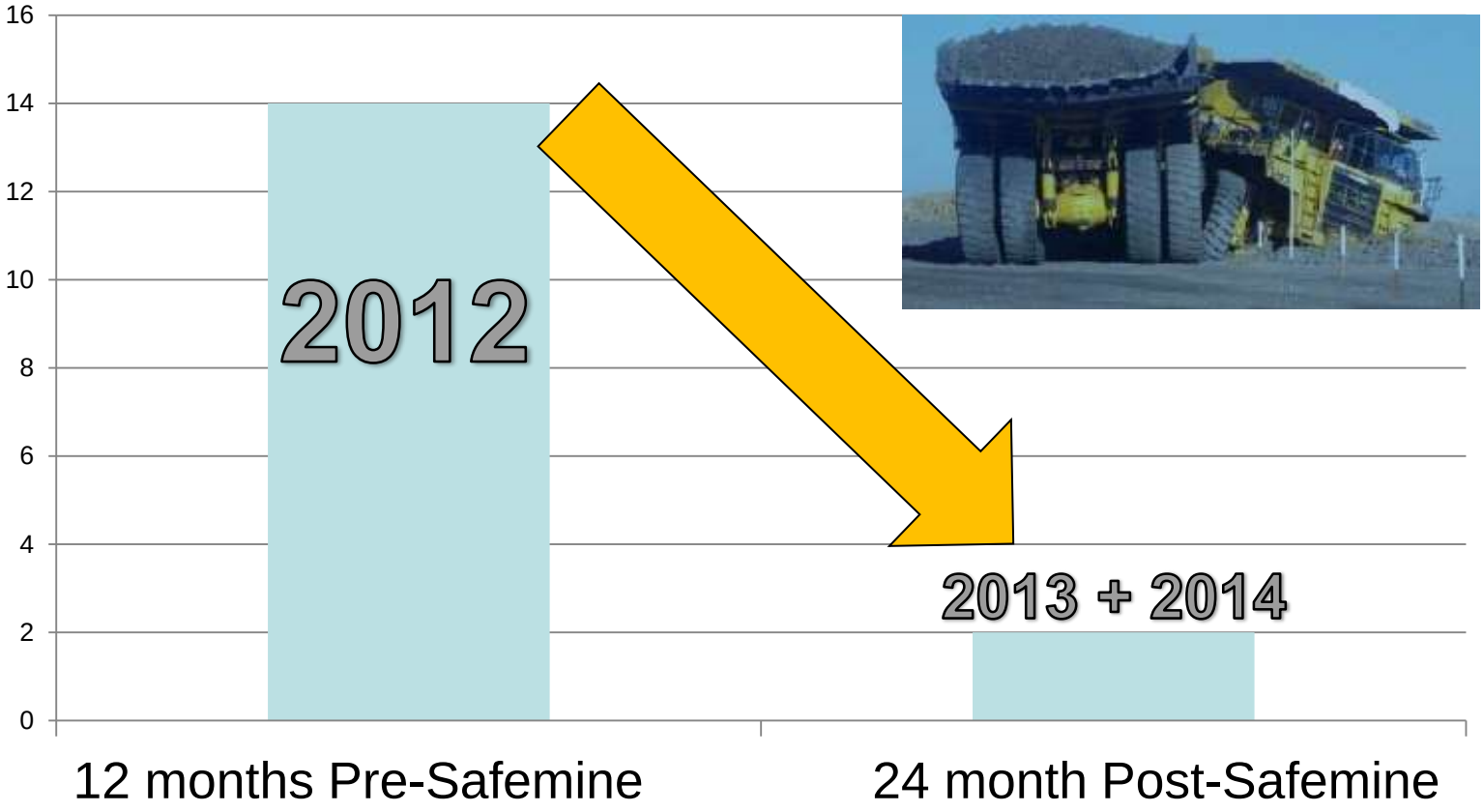
CASE FOR CHANGE – Open-cut

Ravensworth
30 November, 2013

Mt Arthur Mine – 18 October, 2013

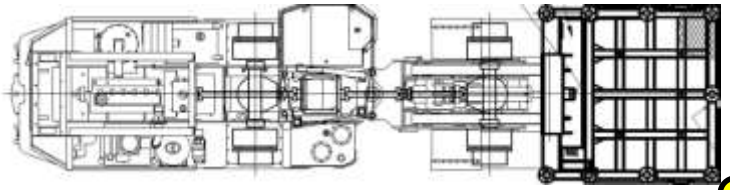
Safemine – Burton & Millennium

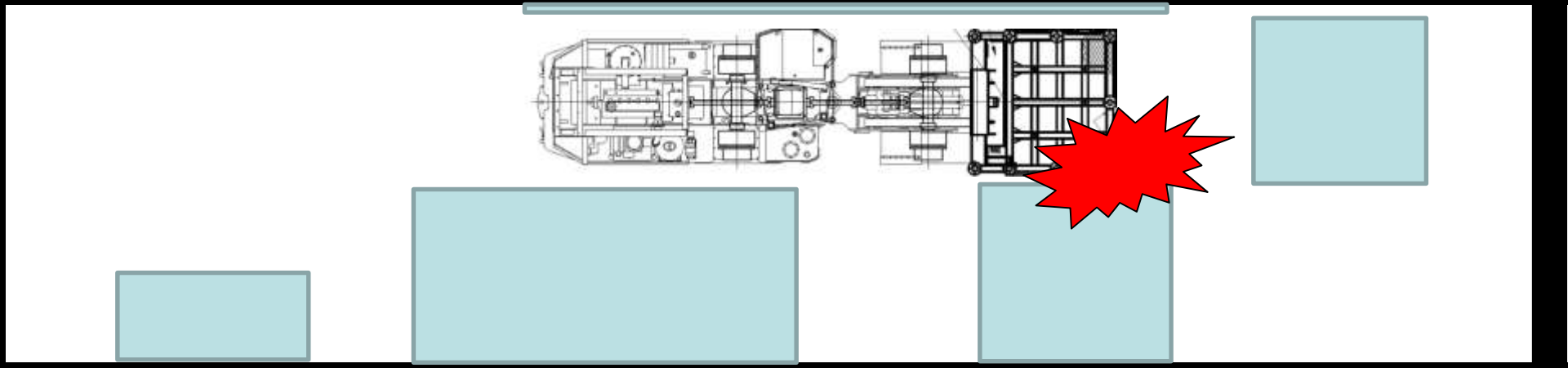
Burton 'SafeMINE' Collision Avoidance Trial



CASE FOR CHANGE - Underground

1. Fatalities at Peabody US operations
2. Fatality in Australian industry
   - Operator found under LHD NSW 2014
   - Moranbah North Coal 9 April, 2007
3. Significant Incidents within Peabody Australia
   - NGC - 30th June, 2010
   - Wambo - 5 December, 2013
   - NGC - 25th June, 2014





Wambo
5th December, 2013

North Goonyella
25th June, 2014

History + Peabody Working Group

2010-11

- Started both open-cut proximity detection and underground collision avoidance projects and taskforces
- Visited mines in South Africa and United States with collision avoidance system

2012 – current

- Started full working trial of open-cut collision avoidance system ‘SafeMINE’ at Burton Mine in Queensland

2011-13

- Surface and NERZ zone trials of MST/Strata underground collision avoidance system at Joy Parkhurst and North Goonyella Mine

2014

- Selection of GE Collision Avoidance System to trial in working development panel of Metropolitan Mine
- Alert mode, prior to moving to shut-down

Two Significant Stall Points

1. Initially some suppliers stated UG proximity detection system could be intrinsically safe
   - Technology aspirations led detailed engineering reviews
   - Power draw for accuracy of system was beyond IS capacity
   - All suppliers now agree flameproof enclosure required for power source
2. Operators want interface with equipment logic
   - Machine changes mode as pedestrians detected at different distances
   - OEM interfaces are complex and proprietary
   - STOP machine and change behaviour

Metropolitan Development Panel Trial

- Continuous Miner and Shuttle Car
  - Tags in cap lamps
  - Enclosure approved

- Commencement - November 2014

- Design risk assessment and data acquisition to support SIL requirements of MDG 2007
  - Initially alert mode and record of pedestrian interactions
  - Final move to halt mode when system proven

U/G System Components

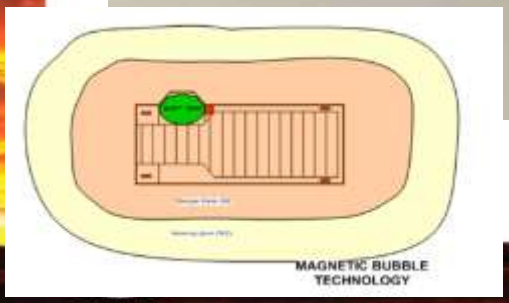
MAGNETIC FIELD GENERATORS

OPERATOR DISPLAY (POD)

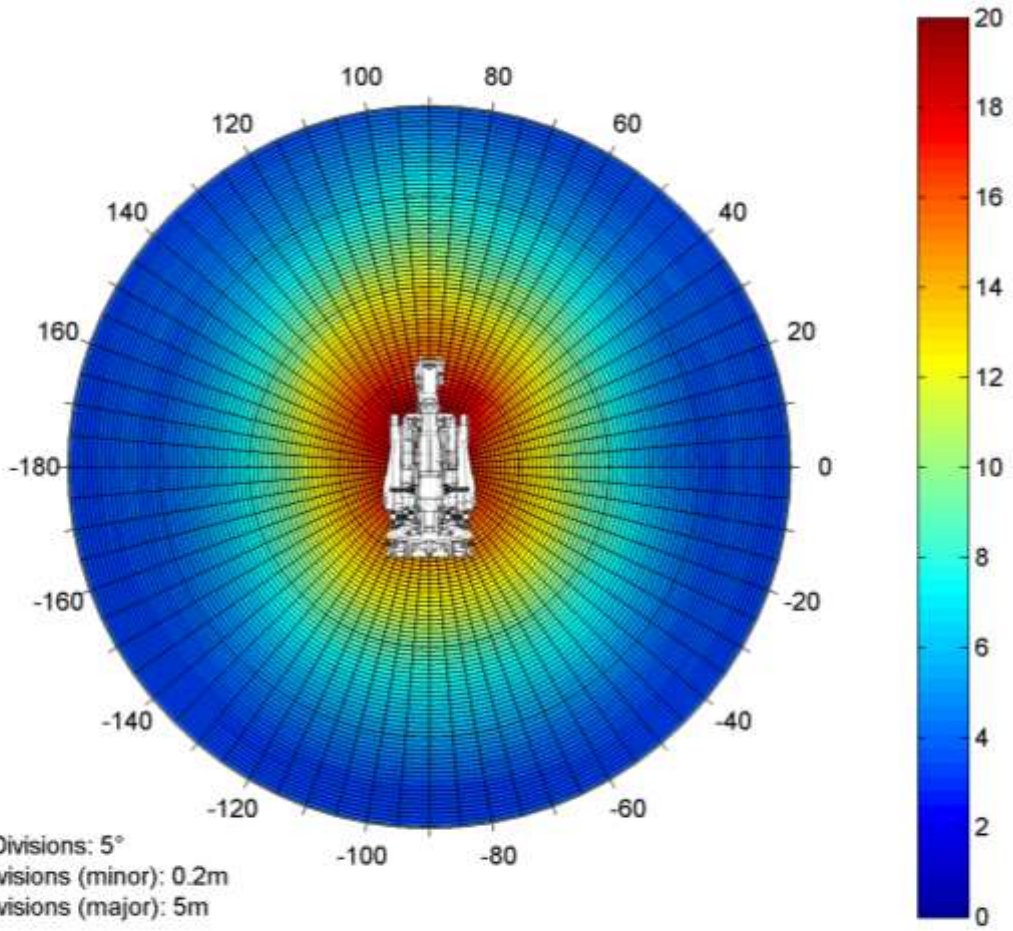
SILENT ZONE GENERATOR

SYSTEM CONTROLLER

PERSONAL ALERT DEVICE (PAD)



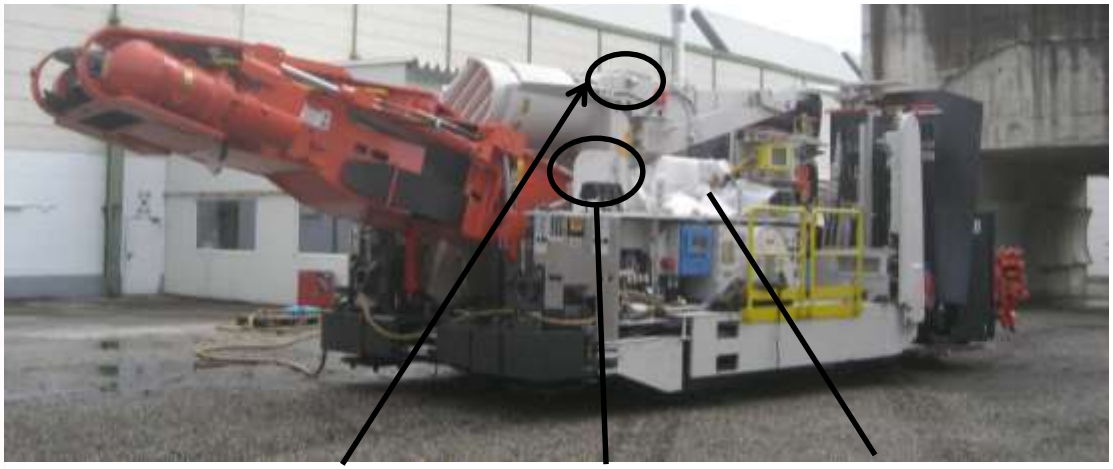
Magnetic field map



Angular Divisions: 5°
Radial Divisions (minor): 0.2m
Radial Divisions (major): 5m

Number of measurment sets:81
Number of samples:5913

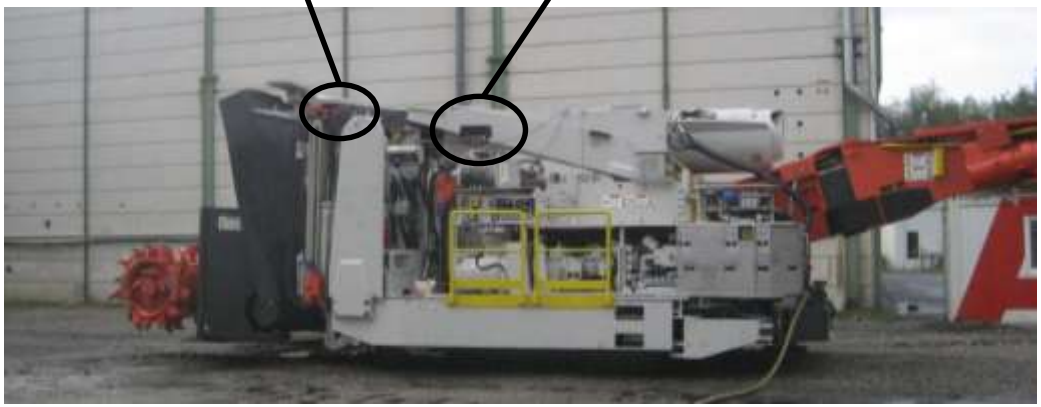
Machine Setup

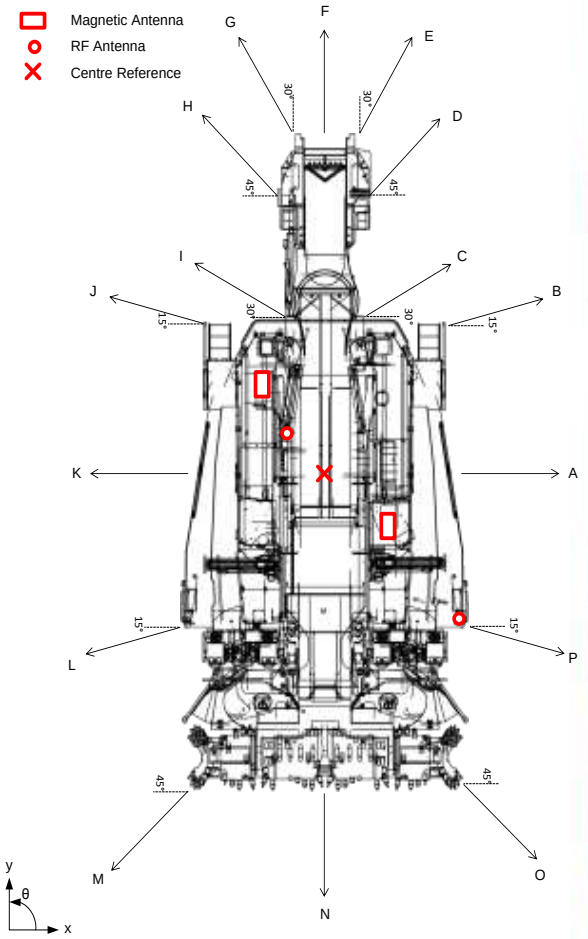


RF antenna

Magnetic antenna

Control &
Interlock Interfaces



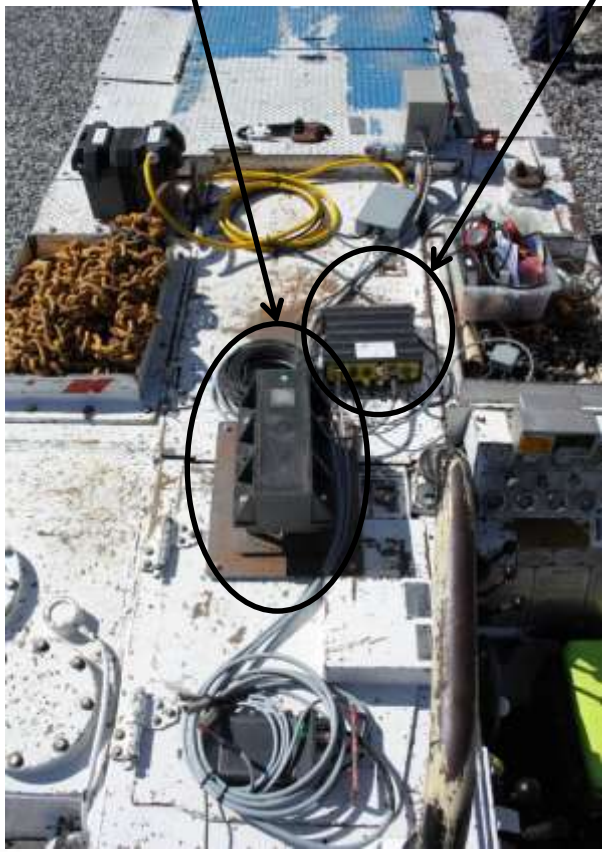


Antenna Location

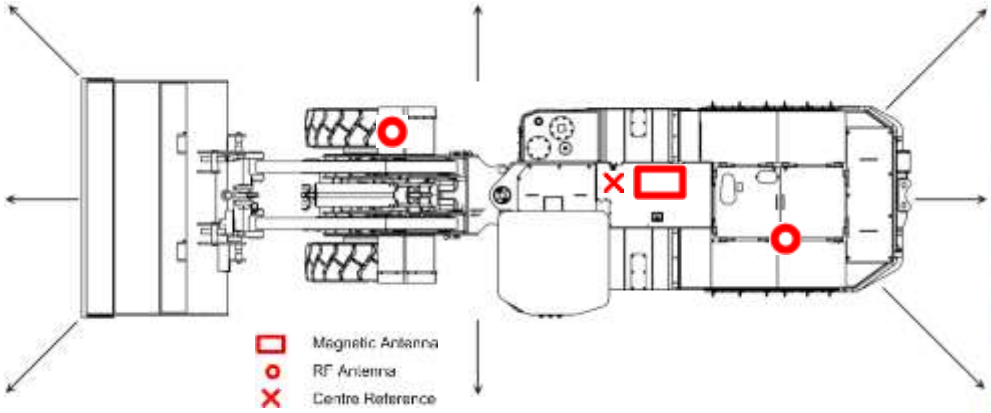
Machine Setup

Magnetic antenna

Controller



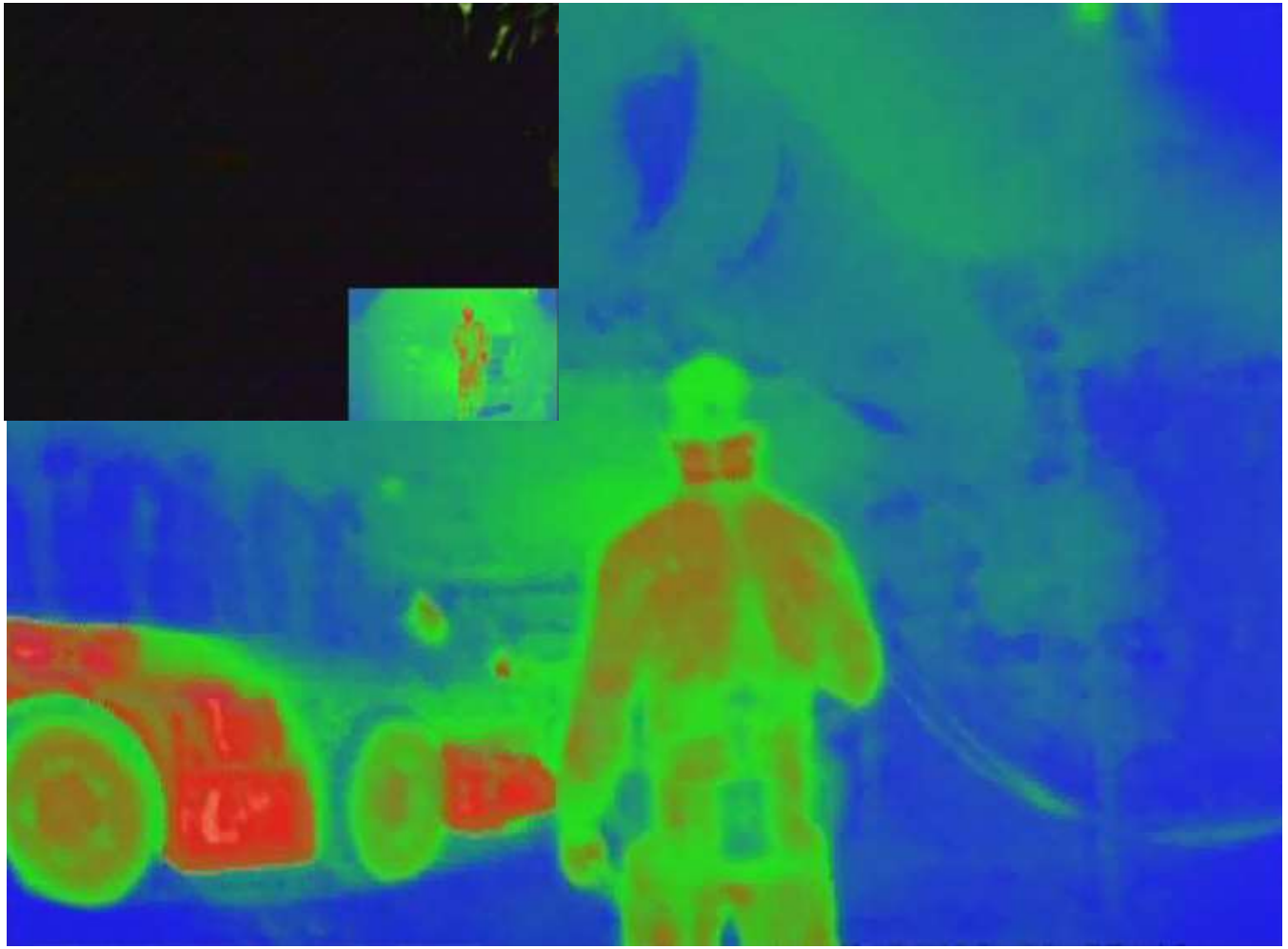
RF antenna



Underground Collision Avoidance

- People in very close proximity to machinery is a real concern
- Fitting of Collision Avoidance Systems on underground mobile equipment is progressing, albeit slower than expected
- Trial underway on a shuttlecar at Myuna Colliery
- Peabody fitting out a working panel for trial
- ACARP trials of all systems planned to be approved in next two years
- Need to focus on taking small steps to help industry progress forwards…we were stuck
- Interaction between OEM systems is still an issue

Thermal Imaging – S/Car and LHD



Thermal Imaging

- Installed on S/car at Metropolitan June 2014
- Operator acceptance was high
  - Vision in blind spots
  - Diluted traditional issues
    - Poor area lighting
    - Dust
    - Sprays
    - Through brattice capability

- Implementing on a LHD at NGC
  - Need to view in front of QDS device
  - Large Cable Reels and Loaded Cookie Plates

Video recognition of pedestrian and link to equipment operating mode?

Future State and Issues

- **UG Proximity - State of Mind**
  - Safety net versus front line tool
  - Psychological studies
  - Operator acceptance
  - Tagging – safety versus performance monitoring

- **CAS – Surface Mining**
  - Whole of fleet
  - System, configuration and logic
  - Fatigue monitoring and management

OEM – Proprietary systems integrated with other equipment