GE is an advanced technology, services and capital company with the scale, resources and expertise to take on the world's toughest challenges. Dedicated to innovation in the areas of energy, health, transportation and infrastructure, we’re committed to leadership, partnership and human progress.
GE’s Technology Leadership

• After more than 130 years, we still hold to our founder’s philosophy: “I find out what the world needs, then I proceed to invent.”
  
  **Thomas Edison**

• Ranked 5th in Best Global Brands for 2011
• Investing $6B in R&D In 2012
• Sponsor 5 Global Research Centers
• Team of 40,000 technologists worldwide
• Created 130 ecomagination products contributing $21B
• Distinguished for process and operational excellence in practices such as Six Sigma and Lean
In mining for more than 50 years

- 1959 – awarded patent for the first OHV electric drive wheel motor
- 1996 – introduced first AC electric drive system; today, 10,000 GE electric drive systems in operation globally
- 2007 – initiated Mining Vertical
- 2011 – announced new $95M state-of-the-art manufacturing plant
- 2012 – introducing GE Mining
GE Mining: How we are organized

Propulsion Systems
- Komatsu
  Propulsion systems

Underground Mining Equipment
- Vehicles
  Equipment

Mining Solutions
- Solving customer problems by packaging GE & 3rd party products for total mine solutions

Organization:

CEO, Mining
Geoff Knox

CFO
Amar Barua

CCO
Rob Moffit

GM
Lori Kieklak

GM
Craig Setter

GM
Peter Carter

Bus. Leader
Greg Sbrocco

Commercial

Propulsion Systems + GE Fairchild

GE Industria

Mining Solutions

Supply Chain
GE Mining: Focus on Solutions

**Power**
- Demand outweighing supply
  - Power supply and reliability in remote areas

**Water**
- Global water crisis
  - Water supply and management/reuse

**Productivity**
- Efficiency
  - Utilization of Capital Process Improvement

GE works with mining customers to be more productive and environmentally responsible
GE Mining: Power Solutions

**Power Generation**
- Steam turbines
- Aero-derivative gas turbines
- Heavy duty gas turbines
- Gas & diesel gensets

**Power Distribution**
- Turnkey substations
- Grid automation
- Electrical balance of plant
GE Mining: Water Solutions

Water Treatment

- Mine Drainage
- Water Reuse
- Desalination
- Mobile water systems
- Thermal evaporative systems
- Heavy metal discharge
- Process antiscalants
- DusTreat dust control
GE Mining: Productivity Solutions

Proficy MaxxMine

Asset Optimization
- Predictive anomaly detection
- Motors, gearboxes, pumps
- Turbines, generators (co-gen)
- Compressors (flotation)
- Mobile assets, crushers, concentrators, conveyors

Process Optimization
- Advanced Process Control tech in RM&D
- Throughput, Recovery & Energy optimization
- Emission optimization
- Packaged solutions for plants, furnaces, etc.
GE Mining: Productivity Solutions

Power Conversion

Extraction
• Mine Hoists
• Motors
• Automation
• Conveyors

Processing
• SAG / Ball Mills
• Crushers

A solutions approach to improve performance and end users' processes
GE Mining: Productivity Solutions

Heavy Haul Trucks
Electric propulsion systems

Locomotives & Signaling
Hybrid & other fuels
OHV Highlights - Integrated Drive System...

**Dynamic Retarding Assembly**
- Dissipates Heat Generated in Retarding

**Control Group**
- Directs Engine & Controls Power Circuit

**Alternator**
- Generates Electrical Power

**Motorized Wheels**
- Propel & Retard Vehicle
Underground propulsion expansion

**Electrification /Hybrid**
Differentiated technology on existing platform ...

**UG Electric Vehicle**
Opens door to new platforms

**Leveraging Core Technology ...**
- Motors
- System Integration
- Advanced Drives
- Energy Storage

**To increase Productivity**
- Customer Benefits
  - Speed on grade
  - Fuel efficiency

**To Lower LCC**
- Customer Benefits
  - Reduced maintenance
  - Greater battery life
GE solutions across mining value chain

**Exploration**
- Soft/Surface (Coal)
- Hard/Surface (Metals)
- Hard/UG (Metals)
- Soft/UG (Coal)
- Auxiliary Processes

**Sensors / geo testing**

**Excavation**
- BWEs / BWRs
  - Elec shvl
  - Draglines
  - Hydr Excts
  - Loaders
  - UG drills / jumbos
  - UG loaders

**Trucks**

**Processing**
- Crushers / grinders / mills / screens
- Floatation cells / leaching equipment
- Smelting

**Power Gen**
**Smart Grid**
**Locos**

**Asset/Process Optimization**
**Safety & Productivity Solutions**
Package into total GE mining offering
The GE Mining Collision Avoidance System (CAS)
Why do we need a Collision Avoidance System (CAS)?
To avoid this!
Clear to go?
When seeing is believing
Heavy Vehicle Limited Visibility

The Haul Truck driver cannot see the objects around the truck due to blind spots.

Blind spot areas around a typical Haul Truck

Areas covered by side mirrors

Blind spot areas around a typical Haul Truck
Eliminate Blind Spots with CAS-CAM

- **Cameras (CAS-CAM)**
  4 cameras provide 360 degree vision around haul truck (front, rear, left, right)

- **Add RF Proximity Detection (as redundancy to GPS)**
  4 RF units provide 360 degree automatic object detection around haul truck (front, rear, left, right) with context based alarming and multiple dynamic zones

- **Add GPS & V2V Radio**
  GPS receiver & V2V radio link provide high speed, long range smart (predictive) proximity alerts with multiple dynamic zones
Principle of Operation

Vehicle Display Unit (with audible & visual proximity alerts)

Optional Cameras (x4) & RF proximity sensors (x4)

Optional RF proximity sensor

GPS Satellites

V-V radio link
# Collision Avoidance System Core Pillars

## Vision Systems
- Blind spot cameras (CAS-CAM)
- Surround view vision
- Video object recognition / alert
- Video recording (pre & post interaction)
- Multi-camera view
- Remote camera
- IR camera

## Proximity Detection
- Stationary / slow speed: CAS-RF 433, CAS-RF 2.4G, CAS-EM, CAS-Radar, CAS-Speed sensor
- Trailing cable proximity detection
- High speed: CAS-RF 2.4G, CAS-GPS, CAS-Speed sensor
- Gyro dead reckoning

## User Interface
- 6.4” LCD
- 7” & 10” Touch Screen
- Remote vehicle alert
- Driver ID
- Road mapping
- Integrated vision & context proximity alerts
- Visual, audible, voice alerts
- Autonomous Vehicles

## Machine Control
- Boom gate interlock
- Vehicle interlocking (take-off, swing inhibit)
- Remote vehicle alert
- Adaptive cruise control

## Personnel Protection
- CAS-PT 433
- CAS-PT 2.4G
- Two-way alarming
- Remote worker monitoring (duress / man-down)
- Autonomous Vehicles

## In Vehicle Monitoring System (IVMS)
- CAS-433
- V-V, V-I, V-P interactions
- Safety Adherence (speeding, excessive braking / cornering)
- Geo-fence alerts / exclusion zones
- Custom events
- Vehicle messaging
- Vehicle engine data

## Fatigue Monitoring
- Lane Guidance / Lane Departure Warning System (CAS-GLS)
- Interface to 3rd party systems (e.g. SmartCap, Seeing Machines, Optalert)

## 3rd Party Systems Integration
- Fatigue Monitoring
- Fleet Management
- Fuel Management
- Tyre Pressure Monitoring
- Other Systems

## Web Reporting (CAS-WEB)
- Event / Interaction / Breach reports
- Journey replay
- Cluster mapping
- Equipment health monitoring
- Geofences
- Vehicle messaging

---

Collision Avoidance System (CAS-CAM/RF®) for Vehicle-Vehicle, Vehicle-Infrastructure & Vehicle-Personnel interactions
Key Components
Display Unit

- 7" touch screen
- Radar style graphic view of surrounding vehicles / objects showing ID, speed, distance, heading and vehicle / object type
- Progressive audible alerts
- Driver acknowledgement of proximity alarms
- Options for audible, visual & voice alerts
- Driver ID input
- Geofence alerts (for no-go / exclusion zones)
- IP44 ingress protection
Display Unit

Stationary View

Moving Forward View

Radar view of surrounding vehicles / objects showing vehicle ID, distance and direction of travel

Vehicle / object list with acknowledge status
Key Components

GPS Receiver / Vehicle - Vehicle Radio Link

- GPS high sensitivity receiver supports all available satellites
- Vehicle to vehicle radio link (915MHz, 500kbps) suitable for up to 500m distance depending on antenna selection & power level (license exempt)
Key Components

In Vehicle Unit (IVU)

• Real-time predictive context based proximity alarming based on heading, speed, stopping distance and vehicle / object type or using predefined alarm rules
• Connectivity: Wi-Fi, Ethernet, GPRS GSM, 3G, 4G, HSDPA, CAN, RS485, RS232, 2 x USB, video (CAS-CAM), digital I/O
• Data Logging of all interactions / alarms, operator responses and equipment health monitoring
• In-Vehicle Monitoring System (IVMS) – vehicle speed, harsh braking / cornering
• Vehicle engine data logging (via CAN bus)
• 3 axis gyroscope for GPS dead reckoning
• 3 axis G-force sensor
• 3 axis magnetometer
• Altimeter
• IP66 ingress protection
• 9-36VDC input voltage
Key Components
Camera Unit

• Day / night camera operates at down to 0.03 Lux
• 123° viewing angle
• Photochromic high impact lens
• IP 66 ingress protection
• MIL-Spec waterproof connection system
• Shock proof mounting system
Key Components
RF Proximity Unit

- 0 – 400m range @ +/- 2m accuracy
- Latest time-of-flight technology for accurate ranging
- License exempt operation at 2.4GHz
- Self-test capability (fail-safe operation)
- IP 66 ingress protection
- MIL-Spec waterproof connection system
Key Components
CAS Web

• Web based reporting system using Microsoft SQL server database
• Generate & view interaction reports
• Create alerts & geofences (for no-go / exclusion zones)
• Trending analysis
• Multiple journey replays
• Cluster mapping (hot spotting)
• Vehicle messaging
• In Vehicle Monitoring System (IVMS) safety adherence reports
• Supports SMS / email alerts
Key Benefits & Features

✓ Simplicity by Design
✓ Intuitive Operation
✓ 360 degree proximity detection around heavy mobile equipment
✓ Driver’s aid that reduces the likelihood of collisions and near misses between heavy mobile equipment, light vehicles and infrastructure
✓ Protect workers at risk when interacting with heavy mobile equipment
✓ Context based proximity alarms using smart algorithms
Key Benefits & Features

✓ Adaptable to mine specific operations using configurable proximity alarm logic
✓ Robust, rugged platform capable of supporting future developments and integrating the latest technologies
✓ Cost effective platform that delivers results and value for money
✓ Compatible with cameras & RF proximity sensors
✓ Supported worldwide by our expert teams
Key Benefits & Features

✓ **Positional Tracking** - precision GPS technology which gives accurate location backed up by an advanced array of tracking aiding G-Force and Gyro digital sensors.

✓ **Connectivity** – Real-time via Wi-Fi, Ethernet, GPRS GSM, 3G, 4G & HSDPA

✓ **Data Logging** – Logs all vehicle interactions / alarms, operator responses, equipment health monitoring and vehicle journey every second. Storage capacity for 30 days of 1 second logs.

✓ **Geo Fences** – for no-go / exclusion zones (e.g. blast zones, voids, obstacles, overhead power lines, speed zones, site separation rule zones)
Key Benefits & Features

✓ CAS Web client – Web based reporting allows end-users to view, administer, create alerts & geofences, send vehicle messaging, setup & generate reports, conduct trending analysis, view key statistics about vehicle interactions & near misses, review multiple vehicle journey replays and cluster mapping.

✓ In-Vehicle Monitoring System (IVMS) – driver ID, vehicle speed, harsh braking / cornering, safety adherence monitoring
Key Benefits & Features

✓ Options

✓ CAS Video - supports cameras for vision of blind spots
✓ High accuracy CAS RF unit (2.4G) provides unparalleled accuracy
✓ Personnel tag
✓ Road Mapping function
✓ Radar integrated with camera system
✓ Lane Guidance (lane departure warning system)
✓ 3rd party systems integration (fatigue monitoring, fuel management, tyre monitoring, fleet management etc)
Key Benefits & Features

✓ Options

✓ Machine Control
  ✓ Boom gate interlock
  ✓ Vehicle interlocking (take-off inhibit, swing inhibit from stationary)
  ✓ Remote vehicle alert function (initiated remotely over wireless communications link within defined alarm zone)

✓ Vehicle Engine Data Logging - via the vehicle CAN bus

✓ Vision System Enhancements:
  ✓ Remote camera (wireless)
  ✓ Surround view camera vision (plan view)
  ✓ Video recording (pre & post interaction / event)
  ✓ Personnel & Object Detection
  ✓ Multi-screen mode
  ✓ Optional 10” monitor
Typical Installation Haul Truck

Combo GPS & V2V antenna & Wi-Fi / GPRS GSM / 3G antenna

Display Unit

Camera & RF Unit (x4) – front/rear/left/right
Typical Installation Dozer

Combo GPS & V2V antenna & Wi-Fi / GPRS GSM / 3G antenna

Display Unit

Camera & RF Unit (x1)
Typical Installation Light Vehicle

Combo GPS & V2V antenna & Wi-Fi / GPRS GSM / 3G antenna (portable magnetic version also available)

Display Unit (portable suction mount version also available)

RF Unit (x1)
Typical Installation Stationary Object

- In-Vehicle-Unit (IVU)
- Combo GPS & V2V antenna
- Wi-Fi or GPRS GSM / 3G antenna
Typical Installation
Boom Gate Control

In-Vehicle-Unit (IVU)  Combo GPS & V2V antenna  Wi-Fi or GPRS GSM / 3G antenna
Typical Interconnection for Basic System

- Display Unit
- In-Vehicle-Unit (IVU)
- Combo GPS & V2V antenna
- Power Reverse IVMS Inputs
- Wi-Fi or GPRS GSM / 3G antenna
- Communications Network
  - Wi-Fi WLAN
  - GPRS GSM
  - 3G/4G
- Internet
  - CAS Web Data Server
  - Workstations

Networks:
- Internet
Typical Interconnection with 1 RF proximity unit (e.g. LV)

Display Unit

In-Vehicle-Unit (IVU)

Combo GPS & V2V antenna

Wi-Fi or GPRS GSM / 3G antenna

RF proximity unit #1 antenna

Power Reverse IVMS Inputs
Typical Interconnection with 1 RF proximity unit & 1 camera (e.g. Dozer)

- Display Unit
- In-Vehicle-Unit (IVU)
- Combo GPS & V2V antenna
- WiFi or GPRS GSM / 3G antenna
- RF proximity unit #1 antenna
- Power
- Reverse
- IVMS Inputs
- Camera Unit #1
Typical Interconnection with 4 RF proximity units & 4 cameras (e.g. Haul Truck)

Display Unit

In-Vehicle-Unit (IVU)

Combo GPS & V2V antenna

Wi-Fi or GPRS GSM / 3G antenna

RF proximity unit #1 antenna

RF proximity unit #2 antenna

Power Reverse IVMS Inputs

RF proximity unit #3

RF proximity unit #4

Expansion Unit

Camera Unit #1

Camera Unit #2

Camera Unit #3

Camera Unit #4
# Alarm Types

<table>
<thead>
<tr>
<th>Alarm Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. no alarm or warning</td>
<td>Warn Beam, Derived from Braking Distance</td>
</tr>
<tr>
<td></td>
<td>Alarm Beam Derived from reaction time</td>
</tr>
<tr>
<td>2. Warning – when 2 warning beams overlap</td>
<td></td>
</tr>
<tr>
<td>3. Alert – when 2 alarm beams overlap</td>
<td></td>
</tr>
<tr>
<td>4. Alarm – when an alarm beam overlaps with an object</td>
<td></td>
</tr>
</tbody>
</table>
## Object Types

<table>
<thead>
<tr>
<th></th>
<th>Truck</th>
<th>Dozer</th>
<th>Grader</th>
<th>Drill</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Medium Vehicle</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Large Loader</td>
<td>Shovel</td>
<td></td>
<td>Scraper</td>
</tr>
<tr>
<td><strong>Small Heavy Vehicle</strong></td>
<td></td>
<td></td>
<td></td>
<td>Light Vehicle</td>
</tr>
<tr>
<td></td>
<td>Dragline</td>
<td>Personnel</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stationary Object</strong></td>
<td>S</td>
<td>Test Station</td>
<td>T</td>
<td></td>
</tr>
</tbody>
</table>
Typical High Risk Interactions

1: Heavy Vehicle (HV) approaching Light Vehicle (LV) at intersection

Risk of LV colliding with HV if doesn’t have clear line of sight to HV and moves into intersection.
Typical High Risk Interactions

2: LV following HV
Risk of LV colliding with HV if LV approaches too closely.
Typical High Risk Interactions

3: HV following HV
Risk of HV colliding with HV if HV approaches too closely.
Typical High Risk Interactions

4: HV passing a LV
Risk of HV colliding with LV if on collision path compared with safely passing.
Typical High Risk Interactions

5: HV Take-off
Risk of HV colliding with LV during take-off in the forward direction.
Typical High Risk Interactions

6: HV Reversing with LV at rear
Risk of HV colliding with LV during reversing. No HV alarm when not in reverse.
Typical High Risk Interactions

7: Swinging Shovel Loading Haul Truck
Risk of Shovel colliding with Haul Truck when rotating.
Personnel Tag

Features:
• two-way alarming with audible & vibrating alert when in proximity of a heavy vehicle
• hard hat or belt mount versions
• typical 20m range
• Requires vehicle RF units for detection
• remote vehicle alert trigger
• remote worker monitoring (man-down alarm)
• option for low frequency electro-magnetic detection that sees through metal and structures. Includes operator alarm mute zone (e.g. inside operator cabin).
• battery powered with contactless charging & low battery alert
• charger station with self-test
Road Mapping

Features:
- Mine road map overlaid on Display Unit for improved situational awareness
- Allows for quick identification of other vehicle positions and approach routes
- Road map automatically updates based on vehicle routes using GPS / gyro dead reckoning bread-crumb trail
Radar

Features:

- Radar object detection integrated with camera vision – cameras can be programmed to automatically switch to zone of detection
- Integrated with in-vehicle Display Unit
- Ideal for object detection during reversing operations to detect walls / bunds / other structures / obstacles
Features:
- Lane departure warning system alerts operator when moving outside pre-defined safe driving lane (e.g. too close to road edge or oncoming traffic)
- Integrated with in-vehicle Display Unit showing graphic of vehicle position relative to pre-defined safe driving lane
- Escalating audible / voice alarm
- System activated on haul roads using GPS geo-fencing
- Road width: typically 40m maximum (minimum 2.5 Haul truck widths)
- Range & Accuracy: 40m maximum +/- 0.1m
**Surround View Vision**

**Features:**
- Multiple camera views joined together to form a consolidated plan view (top down view) – illustration shown on haul truck with 4 cameras (front, rear, left & right)
- Integrated with in-vehicle Display Unit
- Ability to switch between normal & surround view vision
Video Object Recognition

Features:
• Video object recognition (using existing cameras) of personnel, light vehicles, heavy vehicles and fixed plant / equipment (stationary objects)
• Integrated with in-vehicle Display Unit
• Ability to switch to camera in zone of detection with audible / visual alarm
Other Vision System Add-Ons:

- Remote camera (wireless)
- Video recording (pre & post interaction / event)
- Multi-screen mode
- Optional 10” monitor
Features:

• Detect trailing cable of Electric Rope Draglines & Shovels and alert vehicles in proximity in order to avoid a collision which can result in significant damage and production loss

• Integrated with Collision Avoidance System using RF units for alarming in-vehicle Display Unit

• Escalating audible / voice alarm in programmable zones (i.e. outer warning zone, inner alarm zone)

• Range & Accuracy: up to 20m maximum +/- 1m
Reverse Edge Dumping Assistance

Features:

- Reverse edge dumping assistance for Haul Truck dumping operations to ensure that truck reverses square and doesn’t push leading tyre through berm resulting in fall down highwall.

System to measure & display the following parameters:

- Berm tipping distance (up to 10m +/- 0.3m)
- Berm approach angle (90 +/- 10 degrees)
- Berm height measurement (out to 10m +/- 0.3m) – berm height = ½ tyre diameter of the largest haul truck
- Roll & pitch inclination measurement (+/- 0.5 degree accuracy)
3rd Party Systems Integration (onto 1 monitor)

- Fatigue monitoring systems (e.g. Smart-cap, Seeing machines, Opta-alert etc)
- Fuel management system
- Tyre pressure monitoring system
- Fleet management system
- Other in-vehicle systems
Underground CAS – for hard rock & coal mines

PRODUCT OVERVIEW

TYPICAL USAGE SCENARIO

- Cap-lamp Protection Tag
- Personal Protection Tag
- Magnetic Antenna
- Driver's Loop
- Main Controller
- Indicator Unit

TECHNICAL SPECIFICATIONS

Detection:
- Long-range: 50m ±10%
- Close-range: 15m ±1m
- Configurable zones: 3x close range 1x long-range

Main Controller:
- Power: 2x 12V 2A PSU
- Enclosure: Anti-static UHMW Plastic
- Sealing: IP55
- Data-logging & interlocking interfaces available
- IECEx ia I

Driver's Loop:
- Cable loop construction
- Pluggable connection

Magnetic Antenna:
- Range: 20m
- Aspect ratio: 1:3
- Enclosure: Anti-static polymer
- Sealing: Fully potted
- Connection: Multi-pole plug
- Fully tested for safe compatibility with detonators
- Fully compliant with human magnetic exposure limits (STANAG-2345)
- IECEx ia I

Indicator Unit:
- Visible warning
- Audible warning
- Fault indication
- Pedestrian indication
- Vehicle indication

Active tag:
- Tri-axial magnetic sensor
- Power drain: <1mA (Avg)
- Fully encapsulated
- IECEx ia I

Cables & Plugs:
- Timed copper wire, AS1972
- Timed copper braided screens
- Tough polyurethane outer sheath
- Deutsch IR68 connectors

Environmental
- Temperature: -10 to 60°C
- Humidity: 5% to 95% RH
- Vibration: MIL-STD-167-1A

Certification
- IECEx ia I
- IECEx ia 11.00203

GE Title or job number
10/7/2013
Australian Mining Industry Regulator Update on Proximity Detection Technology & Collision Avoidance Technology

- Mining Industry Workshops conducted by QLD & NSW in 2009 & 2010 to raise awareness of the benefits of PDT & CAT – attended by mining Co’s, Equipment OEM’s, Technology OEM’s and Mining Regulators and Inspectors
- **July 2013:** draft Mining Design Guideline (MDG-2007) for the selection and implementation of collision management systems for mining - jointly developed by NSW & QLD Mining Inspectorate, mining Co’s, equipment OEM’s and Technology OEM’s. Due for final release Oct 2013.
- Anglo American (Recommended Practice for Collision Avoidance RP35) & Glencore Xstrata provided background material
Australian Mining Industry Regulator Update on Proximity Detection Technology & Collision Avoidance Technology

• Guideline covers:
  • Definitions for:
    • Proximity Awareness Technology (PAT) (e.g. reversing mirrors, reversing sirens, flashing lights)
    • Proximity Detection Technology (PDT) (e.g. reversing camera, RFID, radar, laser scanner)
    • Safety Adherence Technology (SAT) (e.g. SCADA, IVMS, event reporting database)
    • Collision Avoidance Technology (CAT) (e.g. reversing radar with brake control)
    • Collision Avoidance System (CAS) (e.g. combination of PAT, PDT, SAT, CAT to form a system)
Australian Mining Industry Regulator
Update on Proximity Detection Technology
& Collision Avoidance Technology

• Guideline covers:
  • Risk management
  • Defining the level of intervention
  • Areas of interaction
  • Defining the function of the system
  • Defining the safety zones
  • Developing scope for the system
  • Over-ride for emergency recovery
  • Change management
  • Installation
  • Training
Australian Mining Industry Regulator
Update on Proximity Detection Technology
& Collision Avoidance Technology

• Guideline covers:
  • Commissioning
  • Maintenance
  • System health monitoring & system failure procedure
  • Ongoing system monitoring & review
  • Record keeping & documentation
  • Future proofing
  • Sample surface & underground equipment zones
  • Sample hazard & zone requirement table
  • Risk assessment
  • Links to references / associated documentation
Australian Mining Industry Regulator Update on Proximity Detection Technology & Collision Avoidance Technology

- Guideline may become an Australian Standard which may be referenced in any future legislation
- 2013: QLD Mines Department penning’ draft’ legislation for PDT & CAT for underground initially then followed by surface – 1 to 2 year period for compliance expected
- Sept 2013: QLD Mines Department establishing project to benchmark PDT & CAT and have sought the support of the technology OEM’s and mining Co’s
Australian Mining Industry Regulator Update on Proximity Detection Technology & Collision Avoidance Technology

• Q1 2013: 18 month ACARP project (C22012) commenced by CSIRO on “Proximity Detection Device Open Specification” to Introduce an Open Specification for Collision Avoidance Systems to Achieve Product Interoperability with the key aim to specify a set of communications requirements to be integrated by CAS manufacturers and machine OEMs.

  • Primary Outcomes:
    • **Interoperability**
      - of Collision Avoidance and Proximity Detection products from multiple vendors
    • **Communications Standards**
      – development of protocols required for a device to interact with other devices in a Collision Avoidance System
Summary

The GE Mining CAS provides:

✓ an effective driver’s aid that assists in reducing the likelihood of collisions and near misses between heavy mobile equipment, light vehicles, infrastructure and personnel

✓ 360 degree proximity detection around heavy mobile equipment that uses context based proximity alarms with smart algorithms

✓ comprehensive Web based reporting on all vehicle interactions including journey replay, cluster mapping, safety breach reporting & geo fencing

✓ Ability to integrate with cameras & RF proximity sensors (for backup to GPS)
Summary

The GE Mining CAS provides:

✓ an intelligent platform for expanded Heavy Vehicle Safety System capability including:
  ✓ personnel protection
  ✓ road mapping
  ✓ lane guidance
  ✓ radar
  ✓ Trailing Cable Proximity Detection
  ✓ Enhanced vision systems (pre-post event reporting, surround view, multi-screen mode, remote camera, personnel & object detection)
  ✓ Machine control
  ✓ Integration with 3rd party systems onto 1 monitor
Benefits of the GE solution

✓ Global product support using in-country product specialists
✓ ‘Best of breed’ technical capability
✓ Ongoing commitment to continuous innovation through global GE Research & Development programs
✓ Provider of world class innovative technical solutions and ongoing product enhancements and new product developments
✓ Strong financial position
✓ Provider of financing options
✓ Willingness to partner with customers in developing solutions
✓ Provider of ‘whole of mine solutions’ and integrated systems (e.g. power, water, productivity solutions, transportation, automation)
The Future Of Collision Avoidance?

• Volvo Truck – Collision Warning with Emergency Braking System
  • Article
  • Animation
Questions ?
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The CAS product is a **driver’s aid** and should not be relied upon as the primary means of reducing the risks of high potential interactions between Heavy Vehicles, Light Vehicles, infrastructure and personnel.

GPS based proximity detection may not operate when satellites are not fully visible in the sky (e.g. in a deep mining pit near a high-wall or under a workshop roof). Consideration should be given to supplementing GPS with RF proximity detection and visual aids using cameras.

Alarm logic should be determined via site specific risk assessment based on the end-users specified high risk interactions.

The CAS product does not take control of the vehicle although can provide inhibit signals to prevent movement from a stationary position – implementation will require approval from the vehicle OEM, vehicle owner and GE and a detailed risk assessment conducted.
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