



Equipment safety and performance improvements through the use of a collision avoidance system

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Hexagon Mining - SAFEmine



Hexagon Mining

A solid foundation

In 2014, Hexagon Mining is formed by uniting Leica Geosystems Mining, Devex, SAFEmine, and MineSight

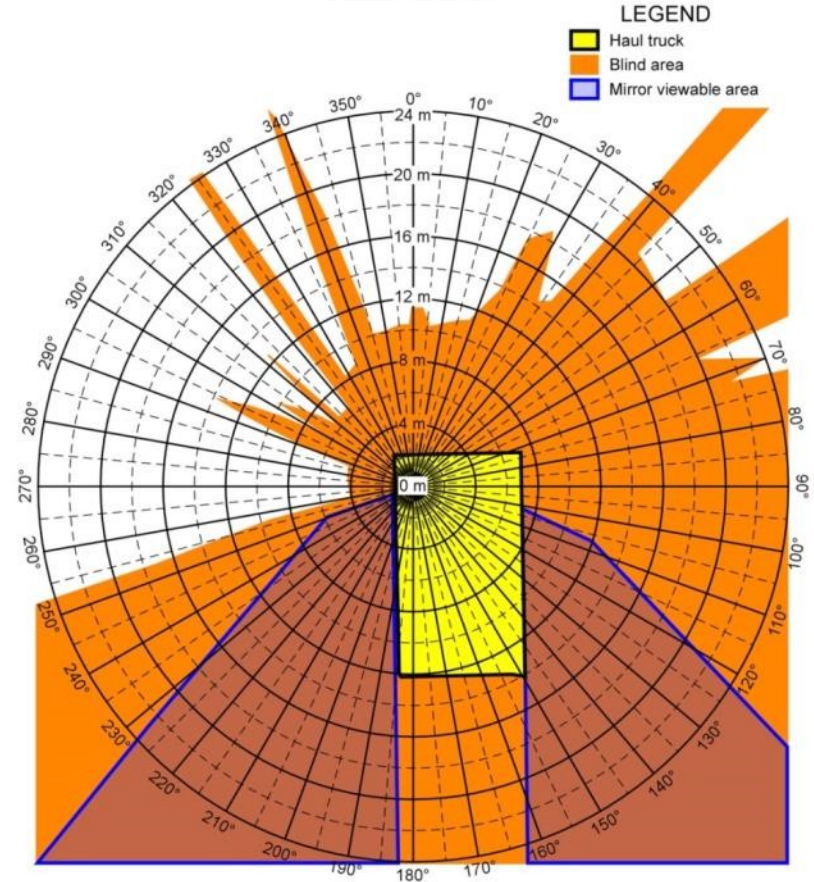


Problem

- Collisions involving equipment, light vehicles, personnel
- Unknown vehicle locations and status
- Limited reporting/analysis capabilities



Blind Area Diagram for Haul Truck
1.5 m Plane
Euclid EH4500

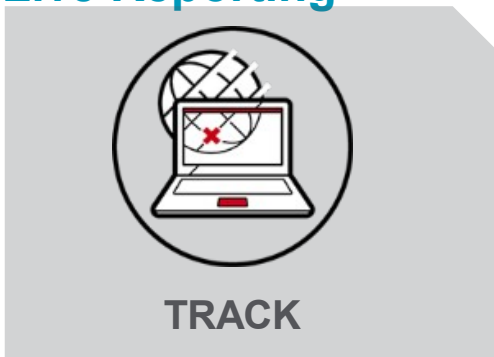


An Integrated Solution

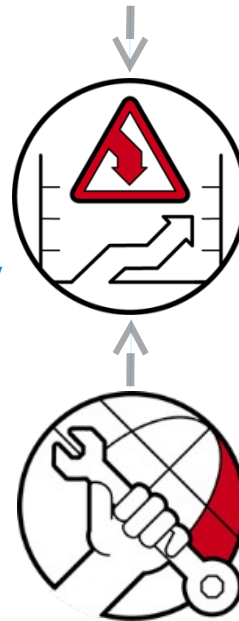
Collision Avoidance



Live Reporting



Increase productivity



Reduce collision risks



Fatigue Monitoring



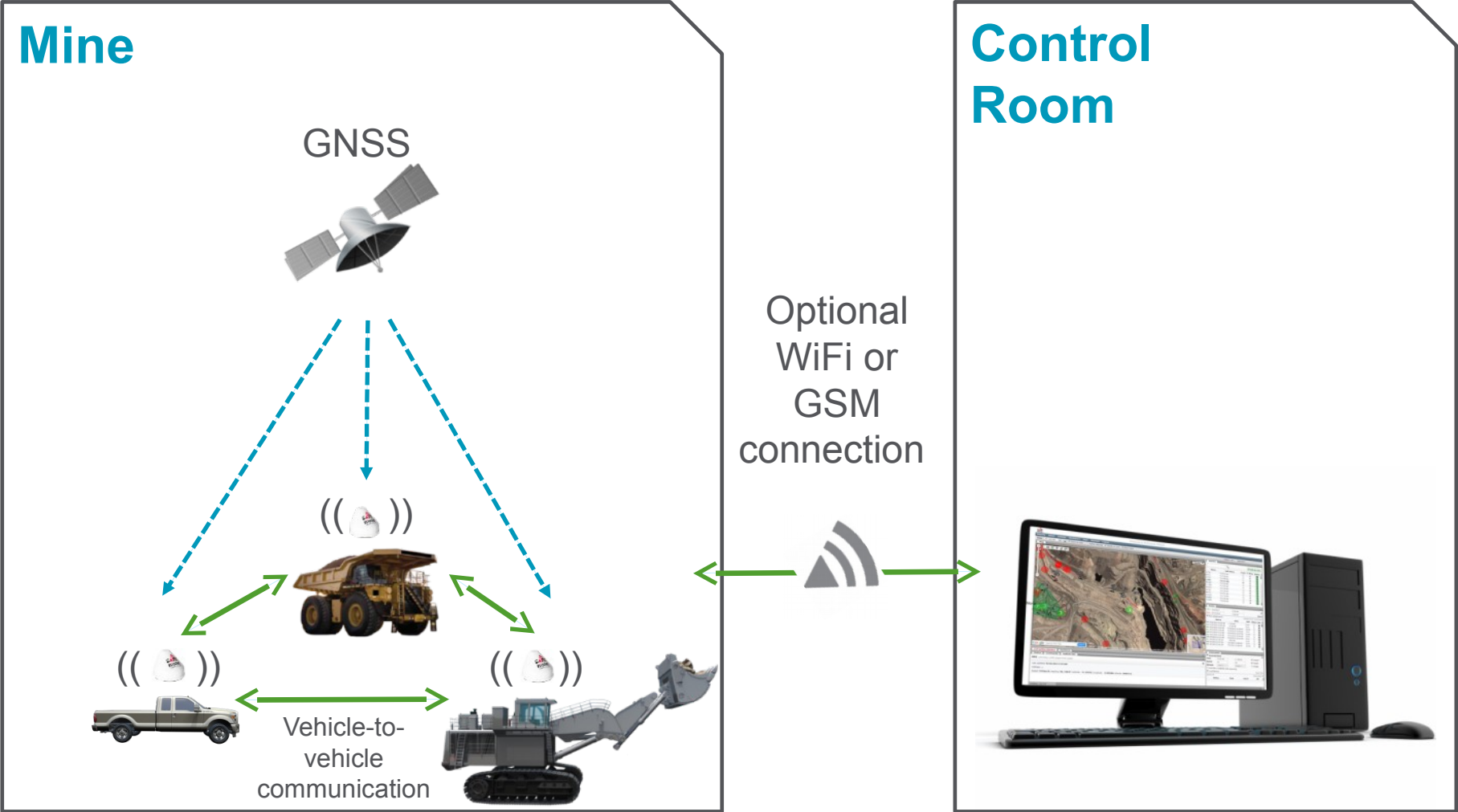
Hexagon Mining's Approach

Safety and productivity improvements:

- Simple and intuitive collision avoidance with low nuisance alarm rate
- Fatigue monitoring and incident prevention
- Collision avoidance processor also used for vehicle monitoring
- Live data sharing with web-based interface working with FMS and mine planning



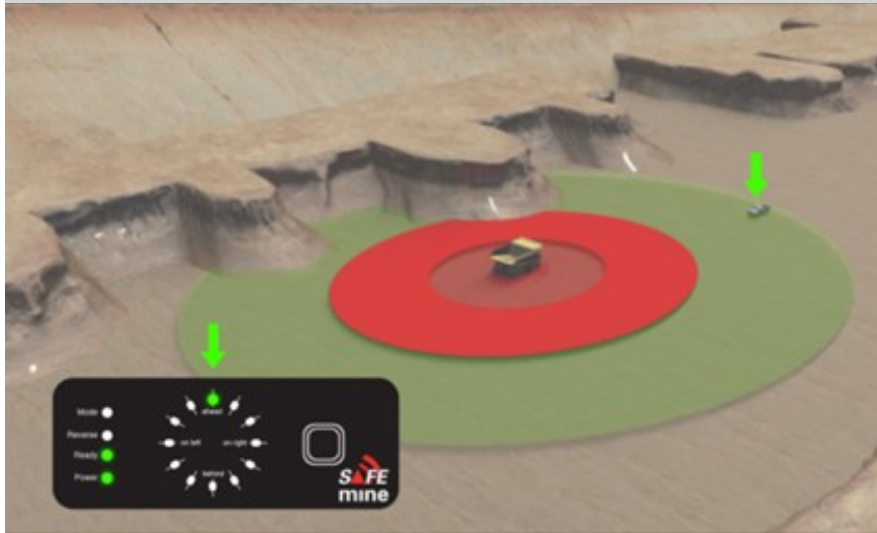
CAS Operating Principle



SAFEmine CAS - Awareness and Avoidance

Level 1: Traffic Awareness

- display indicates surrounding vehicles (360°), no blind spots
- several vehicles displayed simultaneously

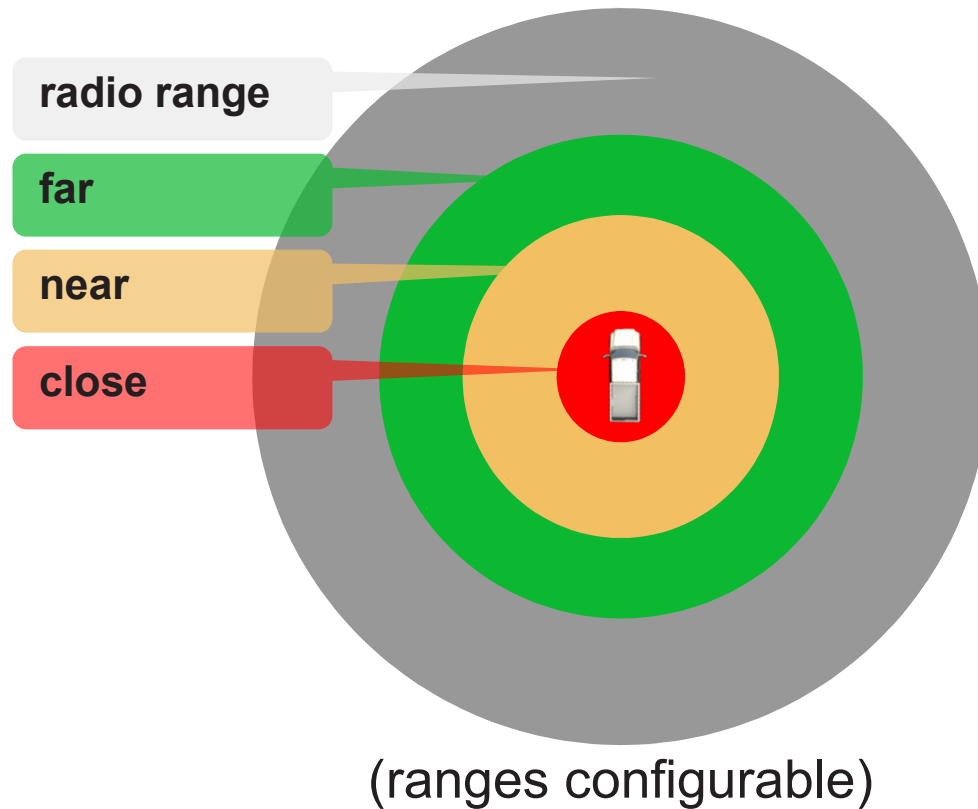


Level 2: Collision Avoidance

- intelligent warnings alert the driver
- based on: [Dynamic Safety Zones](#)

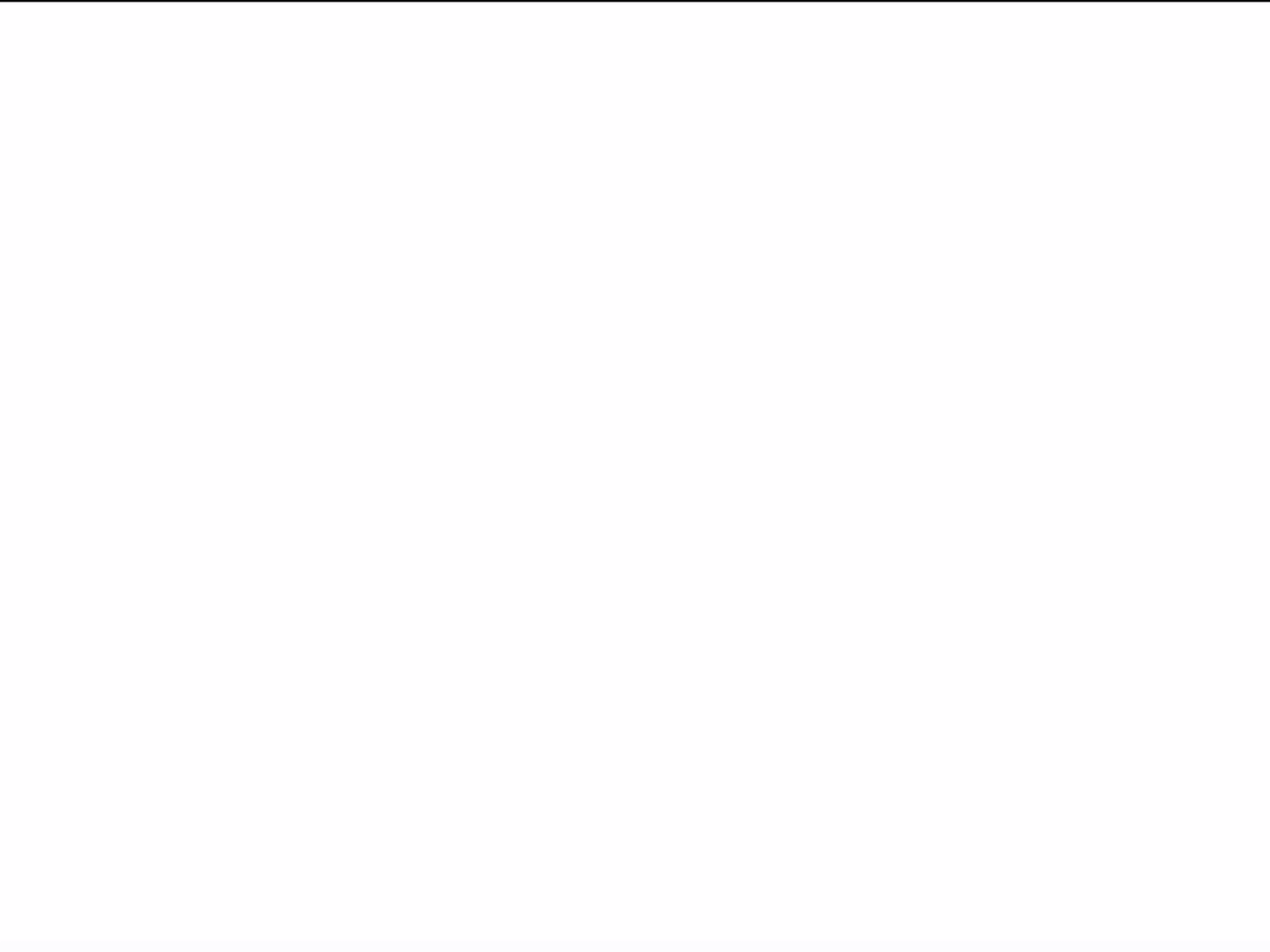


Level 1: Traffic Awareness



- Vehicles are visible up to 800 meters
- 3 configurable alert zones around the vehicle
- Real-time position and heading of vehicles





Level 2: Collision Avoidance

Dynamic Safety Zone (path prediction):

- adjusts safety zone according to speed, direction, vehicle type, braking dist., etc.
- only alarms when vehicles are on collision course (risk-based)
- adapts alarm sounds to the level of potential danger
- alerts the operator causing the dangerous situation



Parked or slow = short DSZ

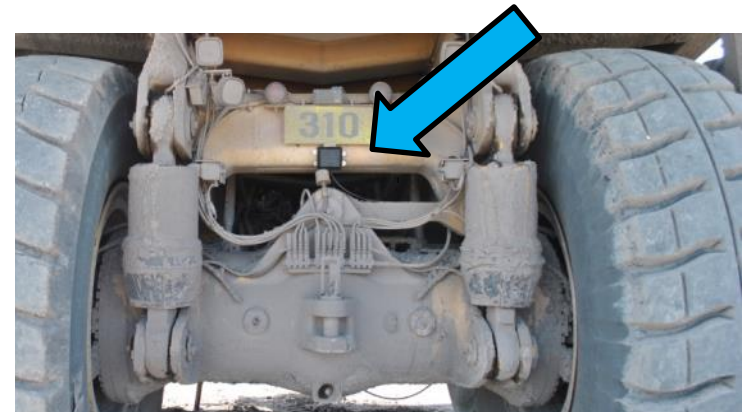
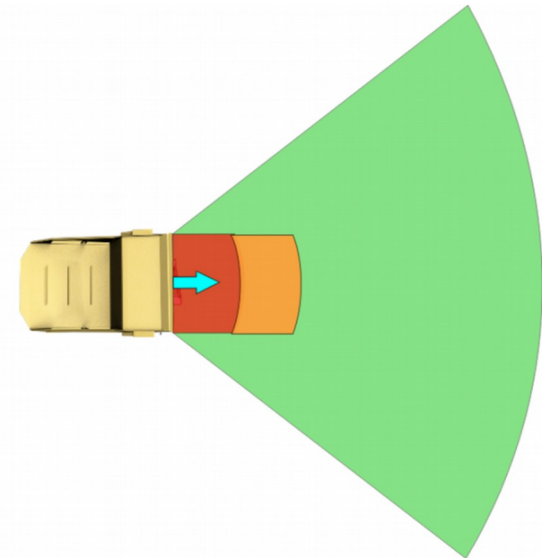


Fast = long DSZ



TrackingRadar

- Detects:
 - Ground personnel
 - Vehicles
 - Fixed hazard (rocks, buildings, berms)
- 2D detection and tracking
- Concurrent tracking of multiple targets to determine collision path



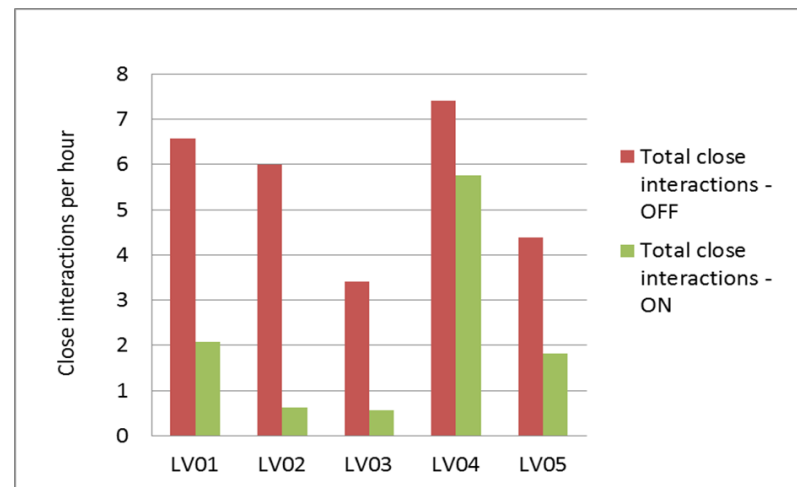
CAS Effectiveness

Maintenance Superintendent, Premier Mine:

“Premier had a more than 53% reduction in metal-to-metal contacts within the year following SAFEmine full implementation. The operators trust the system, the maintenance team has found it to be reliable.”

Peabody reported a reduction in incidents at their Burton mine from 14 machine-to-machine incidents in year prior to SAFEmine, to average of 1 per year after SAFEmine was installed. 2014 Queensland Mining Industry Health & Safety Conference

Trial data shows changes in operator behavior after SAFEmine is implemented



TRACK Live Vehicle Monitoring



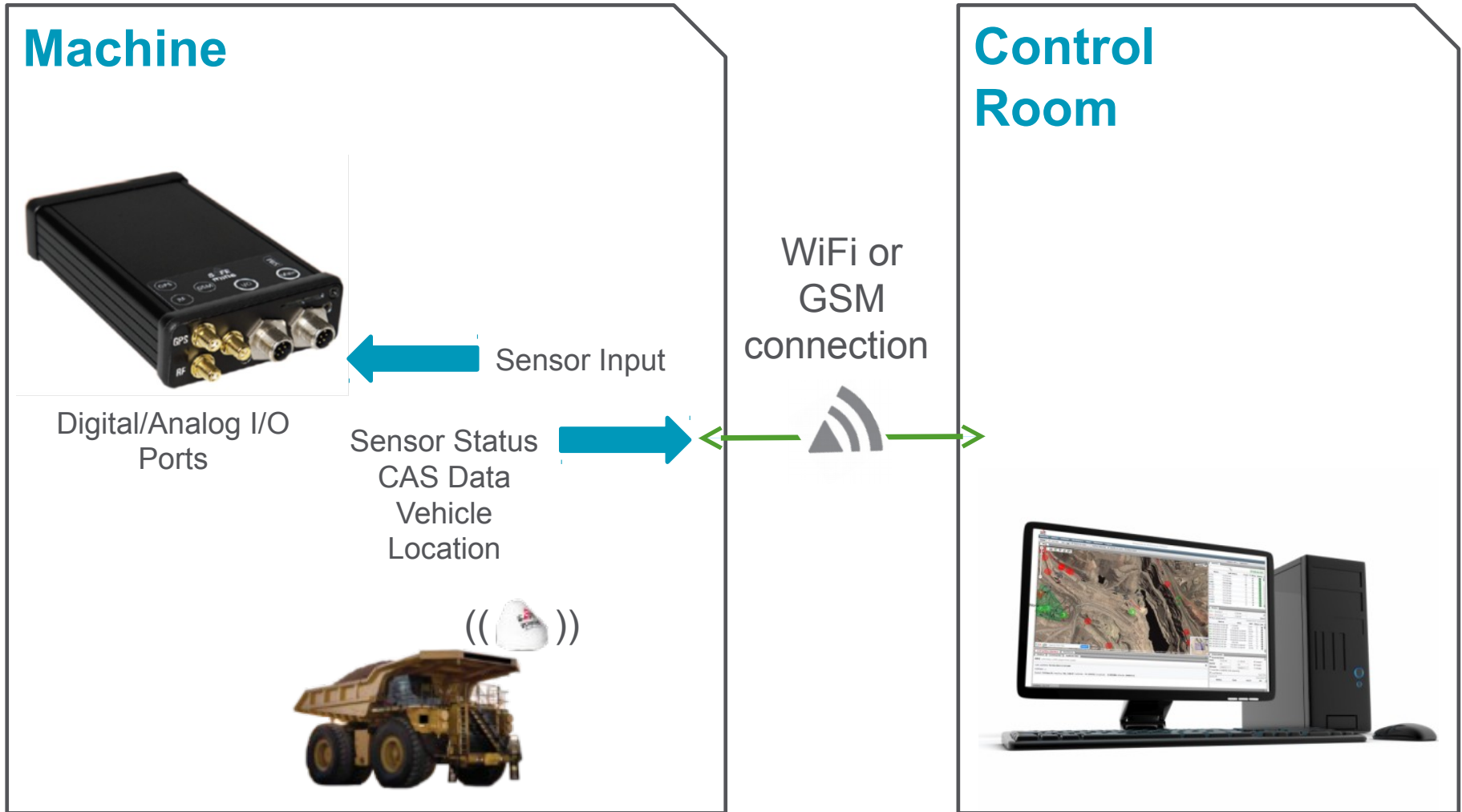
Reports all relevant safety information to your control room



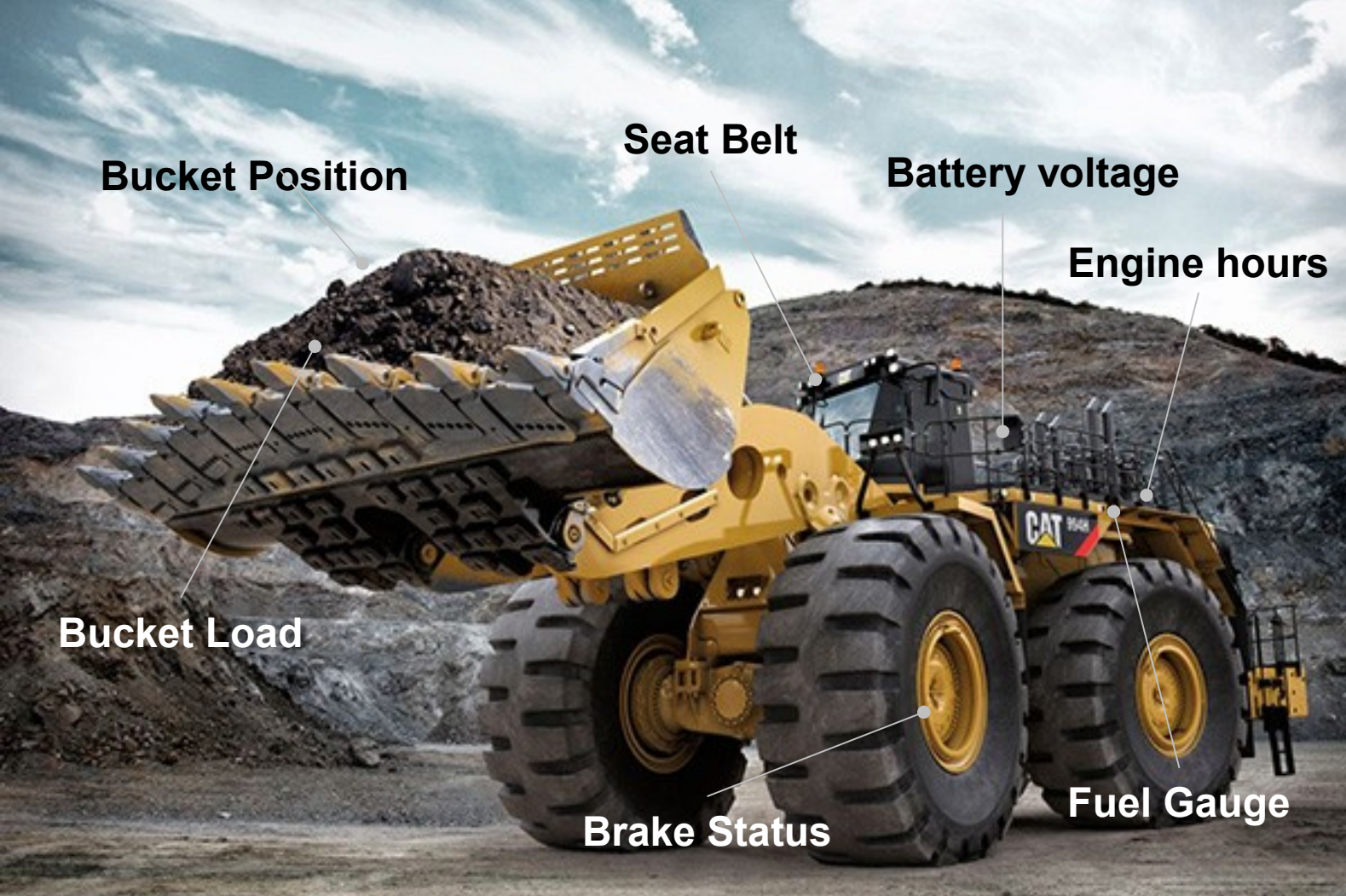
...and to your laptop or smartphone



TRACK Operating Principle



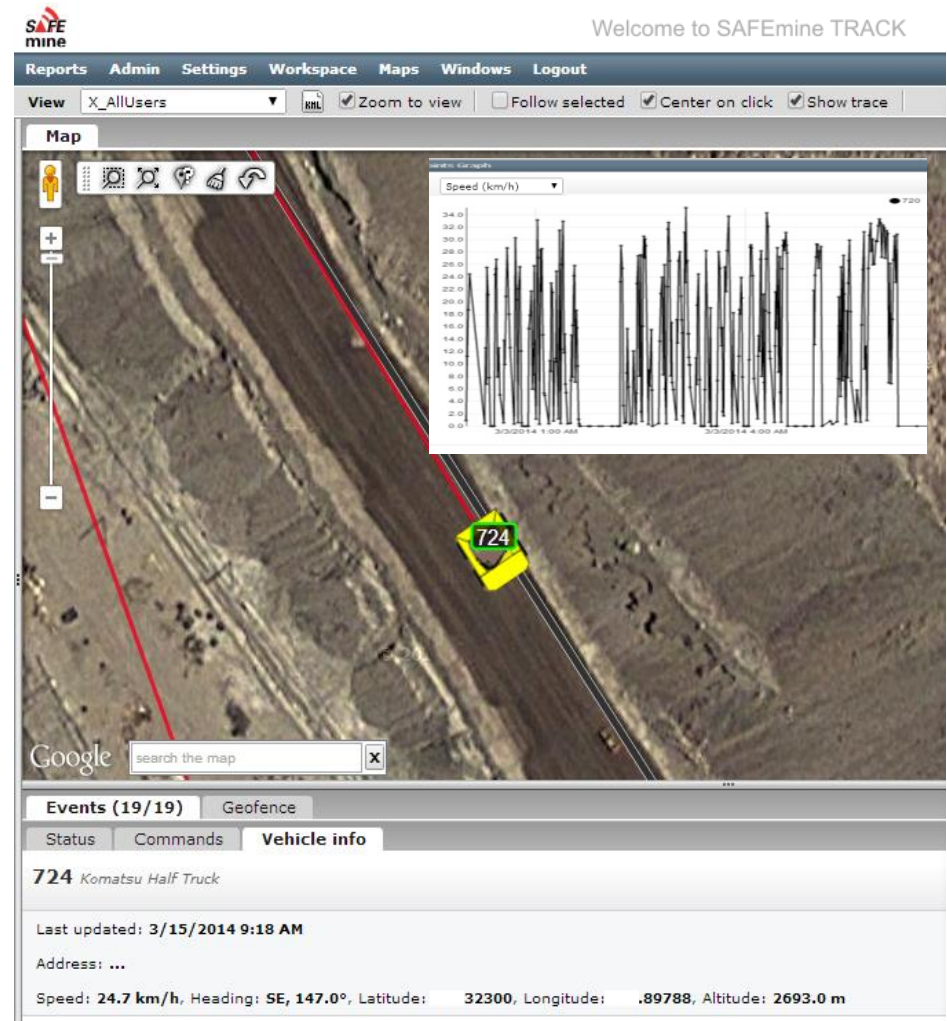
Function: In-Vehicle Monitoring Examples



TRACK: Reporting

Flexible and configurable system for tailored reports:

- Vehicle activity, idle time, speed, sensor status, trip info
- Summaries and event-based
- Vehicle path replay
- Real-time alerts



Options: DriverID / Key Control

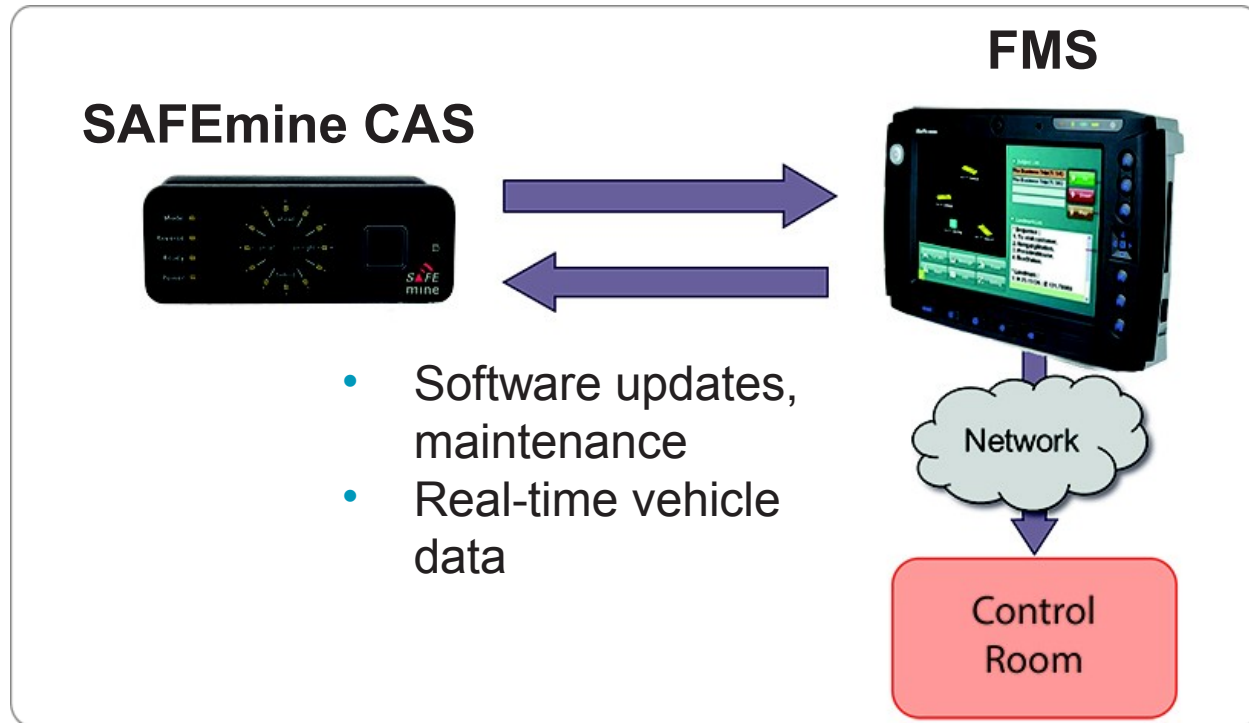


- Know who is operating your equipment
- Collect driver specific reports
- One card to access the mine and start the vehicle
- Prevents unauthorized drivers from starting vehicle (Key Control)



Integration with Fleet Management Systems

- Push toward de-cluttering the cab
- Can work with any Fleet Management System (FMS)
- CAS, FMS, TRACK work together for complete vehicle monitoring
- Current focus on Leica Jigsaw integration



Water Truck Usage and Optimization

Problem: Mine needed to improve dust control measures and efficiency of water trucks.

Solution: SAFEmine TRACK used to track path of water truck and watering status, and generate reports.

Sensor inputs:

- Water pump on/off
- GPS location
- Truck speed

The screenshot displays the SAFEmine TRACK software interface. On the left, a satellite map shows a mining site with a yellow truck icon labeled '00-150' and a blue polygon labeled 'Linea 45'. A red callout box points to the truck icon with the text 'ID and icon attribute.'. On the right, the 'Vehicles' table lists vehicle details, with a blue callout box pointing to the 'Idle Time' column containing '00:01:48' and the text 'Idle Time and Watering Status.'. Below the vehicles table is a 'Tracks' section with filters for 'Start' (2/22/2014) and 'End' (1:11 PM). At the bottom, there is a 'Track points' table with columns for 'Date', 'Time', 'km/h', and 'Alt'.

Name	Last seen	Track	Status	Idle Time	Regando
00-150	11:20:52 PM			00:01:48	

Date	Time	km/h	Alt
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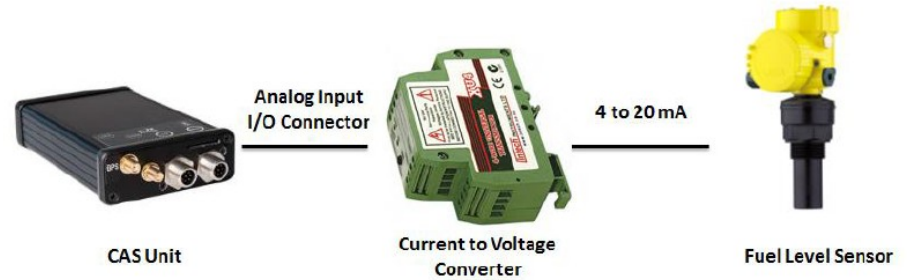


Fuel Level Monitoring

Problem: Mine needed a method to track and optimize refueling activity and tank refill.

Solution: SAFEmine TRACK used to monitor fuel level in fuel bowsers for usage analysis and scheduling.

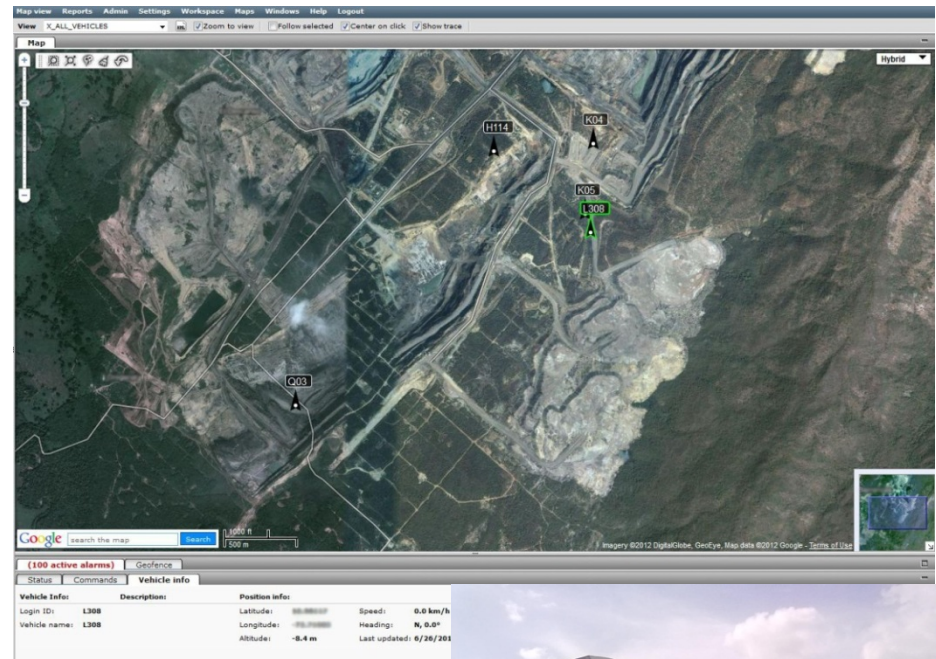
- Sensor inputs:
- Fuel level



SAFEmine TRACK for Maintenance Dispatch

Problem: Inefficient and slow dispatch of service trucks.

Solution: SAFEmine TRACK used to locate and dispatch nearest service truck to equipment in need.



Fatigue Monitor – Control Room

SAFE mine
07:52 | Test User

home > Operator List
Welcome Test User

Operator Cerrejon_16
✕

Patriotas
22781

Search: e.g. event type, date (YYYY-MM-DD), etc.

Date, Time Time since	Event Type Value	Fatigue Risk	Speed	Download Details
2015/03/26 06:37:49 COT 01:15:14 ago	MicroSleep 2.97 sec	MED	17 km/h	⬇
2015/03/26 06:34:08 COT 01:18:55 ago	PerClos 41 %	LOW	27 km/h	⬇
2015/03/26 06:23:08 COT 01:29:55 ago	MicroSleep 2.17 sec	LOW	23 km/h	⬇



Summary

Safety and productivity improvements through:

- Complete traffic safety solutions
 - Collision avoidance
 - Personnel and untagged object detection
 - Fatigue monitoring
- TRACK live monitoring and reporting
- Vehicle status and sensor monitoring for all vehicles
- Integration with FMS
- Analytics



For more information:

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