

Real time distraction detection and warning system improves safety on public roads **and reduces operating costs in commercial fleet**

A case study

*First International Conference on Driver Distraction and Inattention
Lindholmen Science Park, Göteborg, Sweden. 28-29 September 2009*

Dean Croke

VP Automotive Products

dean.croke@seeingmachines.com

Dr Nick Cerneaz

CEO

nick.cerneaz@seeingmachines.com

Seeing Machines Limited



The French national institute
for transport and safety research



Parameters - Background

- Private fleet operator – global oil field services business
- ~8,000 commercial vehicles total
(study: 18 vehicle sub-fleet from 1 depot)
- 24 x 7 operation, long shift hours – harsh conditions
- High value vehicles and high value operation
- High rate of serious accidents.
- Major loss in January 2008, precipitated present work
- Management hypothesized that **driver inattention** within the fleet was a contributing factor



Parameters – Commercial Fleet's Aims

- **Client's Broad Objectives**
 - Improve employee safety by significantly reducing incidents
 - Identify actual causes of accidents
 - Develop and implement technological solutions that can be integrated into existing global operations
 - Reduce fleet operating costs
- **Driver Performance Management – client has already implemented all the usual standard efforts, including:**
 - Pre-Trip: driving hours, fitness for duty, predictive modelling
 - In-Trip: GPS data via telemetry
 - Post-Trip: hard braking event recording and feedback, etc.,



Parameters – Proposed methodology

- Proposed methodology – Current status
 - themes: Monitor, Feedback, Education, Countermeasures
 - phases: Stand-alone pilot, fleet-wide integration; roll-out
- Pilot deployment: Monitoring, Feedback, Education
 1. Monitor Distraction and Drowsiness events
 2. Event feedback: *immediate* driver intervention
 3. Sleep Science Education: workshop for Drivers and all local managers, dispatchers and controllers → user buy-in
- Phase 2: (in implementation now)
 4. Dispatch feedback and fleet wide dynamic control
 5. Business level countermeasures and extended training

Phase 1: Stand-alone Pilot

- 18 vehicle sub-fleet from one depot in southern USA
- Class 8 heavy rigids, ~35t, high centre of gravity



Operational parameters

- 24 x 7 operation, 18 vehicle sub-fleet
- Up to 60 drivers across the sub-fleet in 24 hr period
from 1 to 5 drivers / vehicle / 24-hr period
- Each vehicle average ~150 miles/day
- “FULL EVENTS” are primary performance assessment
 - “Full Event”= extreme G-force deceleration = vehicle wreck or severe hard braking event consistent with major incident
 - determined by onboard accelerometers and logging equipment as part of existing in-vehicle telemetry systems

Pilot attributes: Monitor, Feedback, Education

1. Monitor Distraction and Drowsiness events
DSS (Driver State Solution) from Seeing Machines
2. Event feedback: *immediate* driver intervention
Audio alerts, vibration seats systems – from DSS
3. Sleep Science Education: workshop for Drivers and all local managers, dispatchers and controllers

Direct Driver State Sensing



- **Naturalistic Sensing Technology**
 - Non-contact, non-intrusive, camera based, direct driver observation
 - Fully automatic, no-setup/calibration
- **Real-time image processing**
 - No CCTV / video recorder
 - Image processing and analysis system generates driver “data” in REAL-TIME
- **Most important Data Points**
 - Eyelid closure → Microsleep
 - Head pose/orientation → Distraction

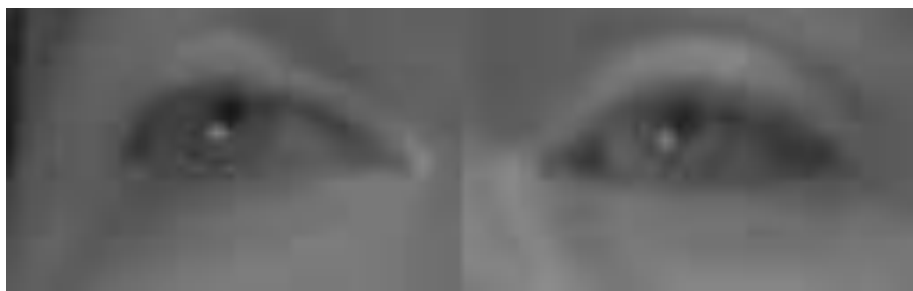
Driver State Sensor

Driver Distraction



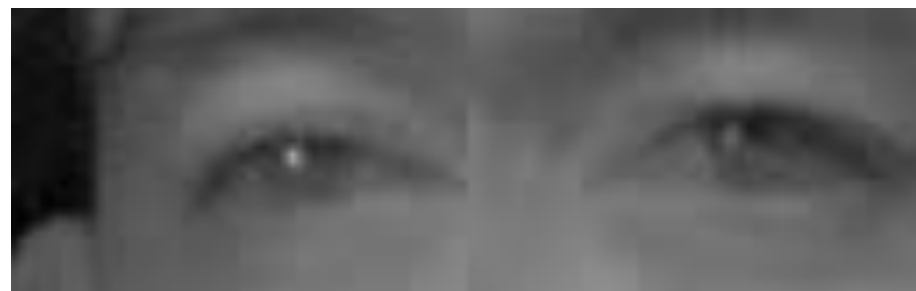
DSS examples: Eye Video clips

Drowsiness events

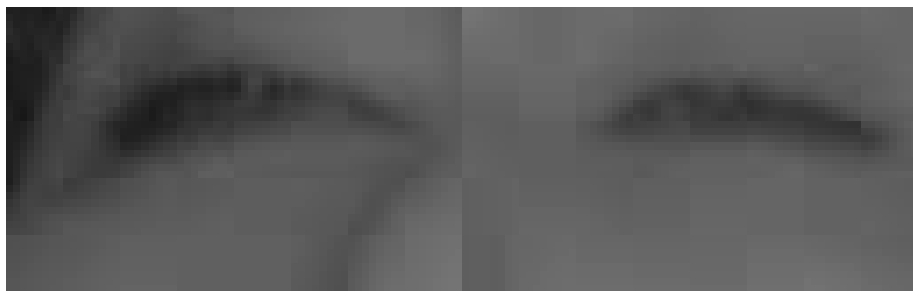


Microsleep

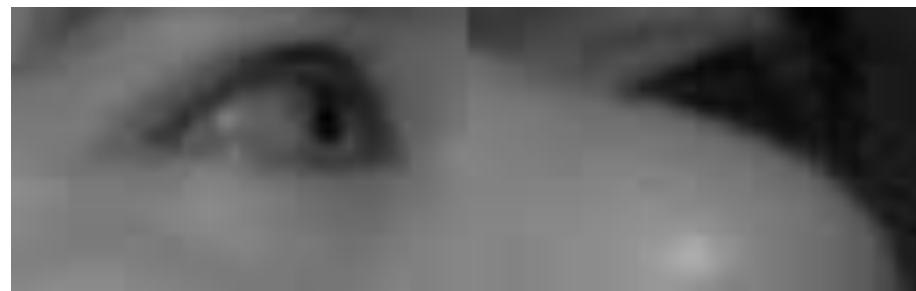
Distraction events



Sideways eye glance



Microsleep with head nod



Head rotation side glance

Distraction Detection

- Extended period of attention diverted from the “road ahead” direction
- Head rotation follows attention
- Road ahead defined at $\sim \pm 25^\circ$ (also a dynamic speed dependency)



Management Reporting:

- Events

Other reports

- Trips
- Driver
- Fleet-wide

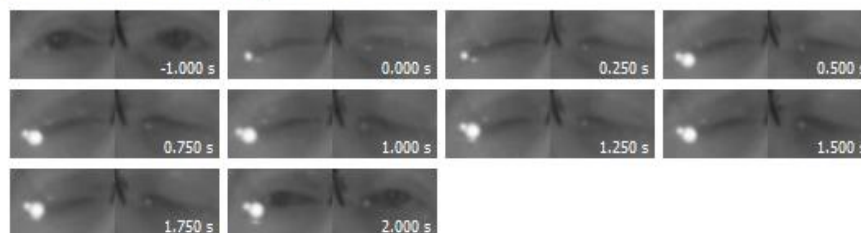
Event details

Type: Microsleep
 Vehicle: DS-DSFS-V006-S042
 Time: Fri 29 May 2009 10:12:02 AM (UTC+10)
 Location: [34.8390 S, 149.5693 E](#)

Map

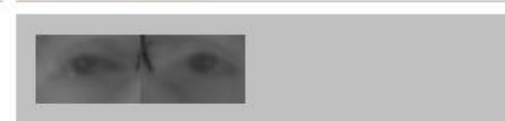


In-vehicle camera (frame-by-frame)



[Toggle image display](#)

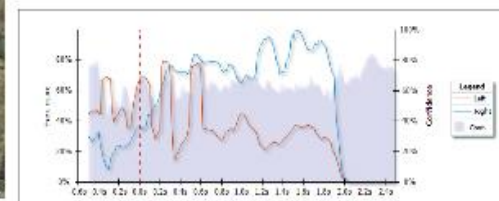
In-vehicle recording



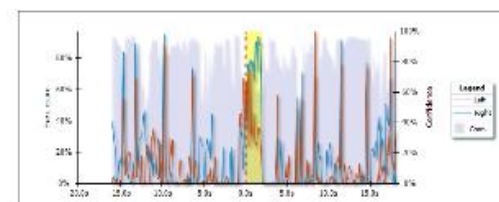
Other event details

Sensor: DS-DSFS-V006-S042
 Version: 3.2.1.55876
 Distance from start: 70.789 km
 Duration: 2.00 seconds
 Speed: 110 km/h
 Distance travelled: 0.061 km
 Course: 76°
 PERCLOS: 4.31%
 Frame number: 163987

Eye closure



Event vicinity chart



Trip start

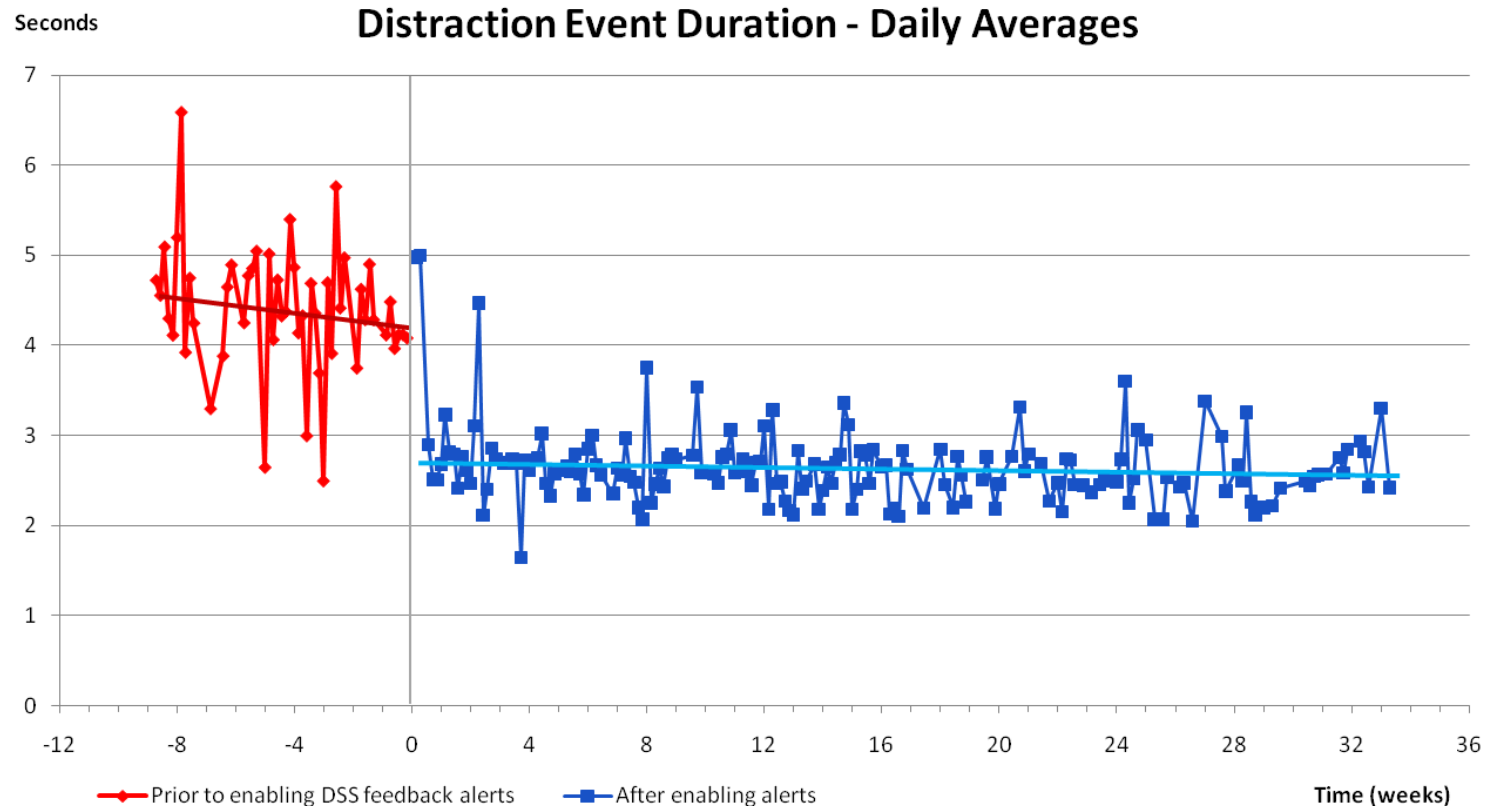
Time: Fri 29 May 2009 09:26:31 AM (UTC+10)
 Location: [35.2743 S, 149.1325 E](#)



Pilot status

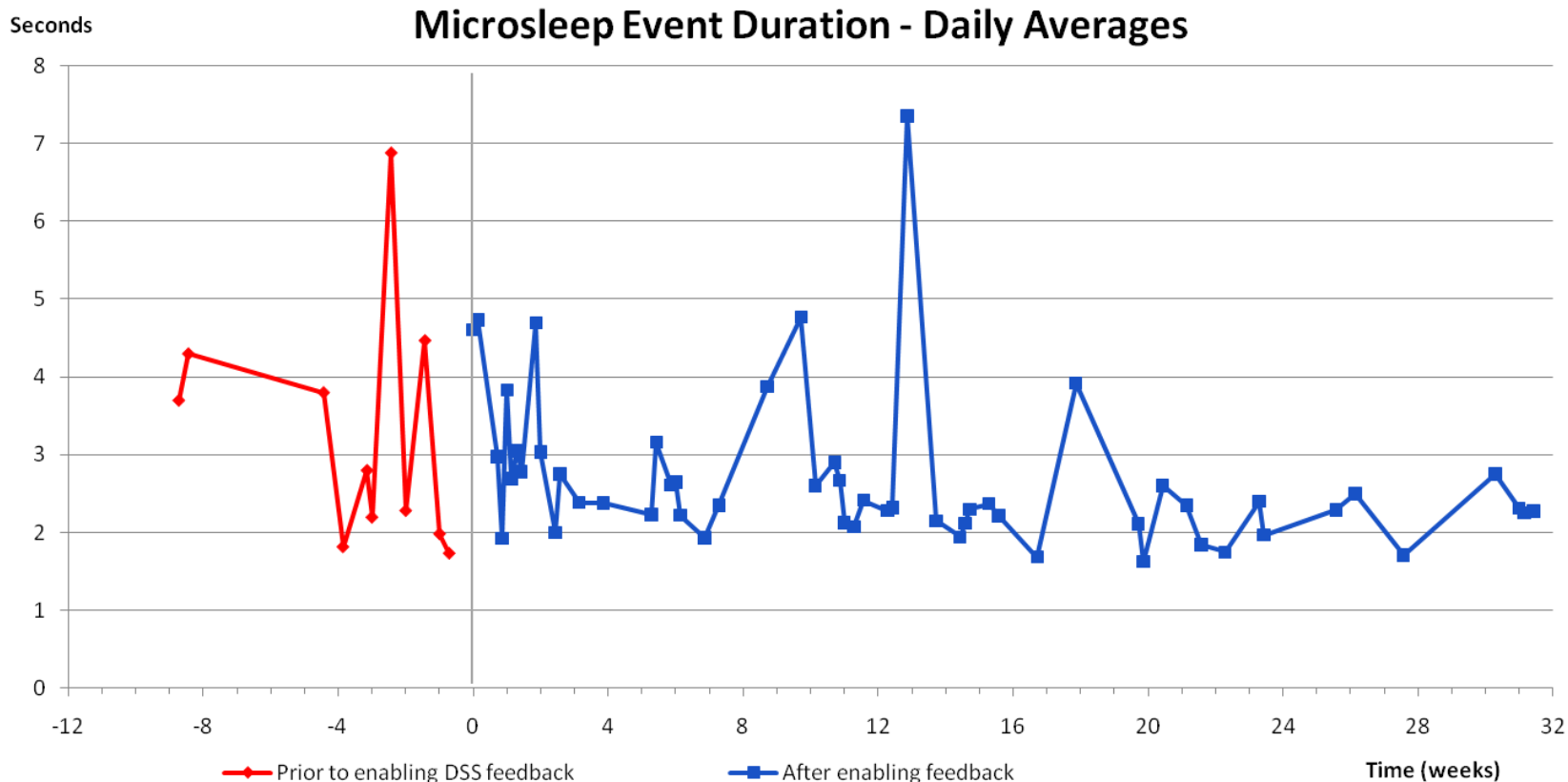
- ~9 weeks of baseline data collected initially, then
- ~33 weeks of data collection (as of last week)
- 86,000 miles travelled
- Per truck average ~150 miles/week
 - varies within range of 0-2000 miles/truck/week
- Phase 1 complete with excellent results
- Phase 2 in progress at present (fleet-wide integration)
- ... So it is a work in progress

Driver Distraction Events



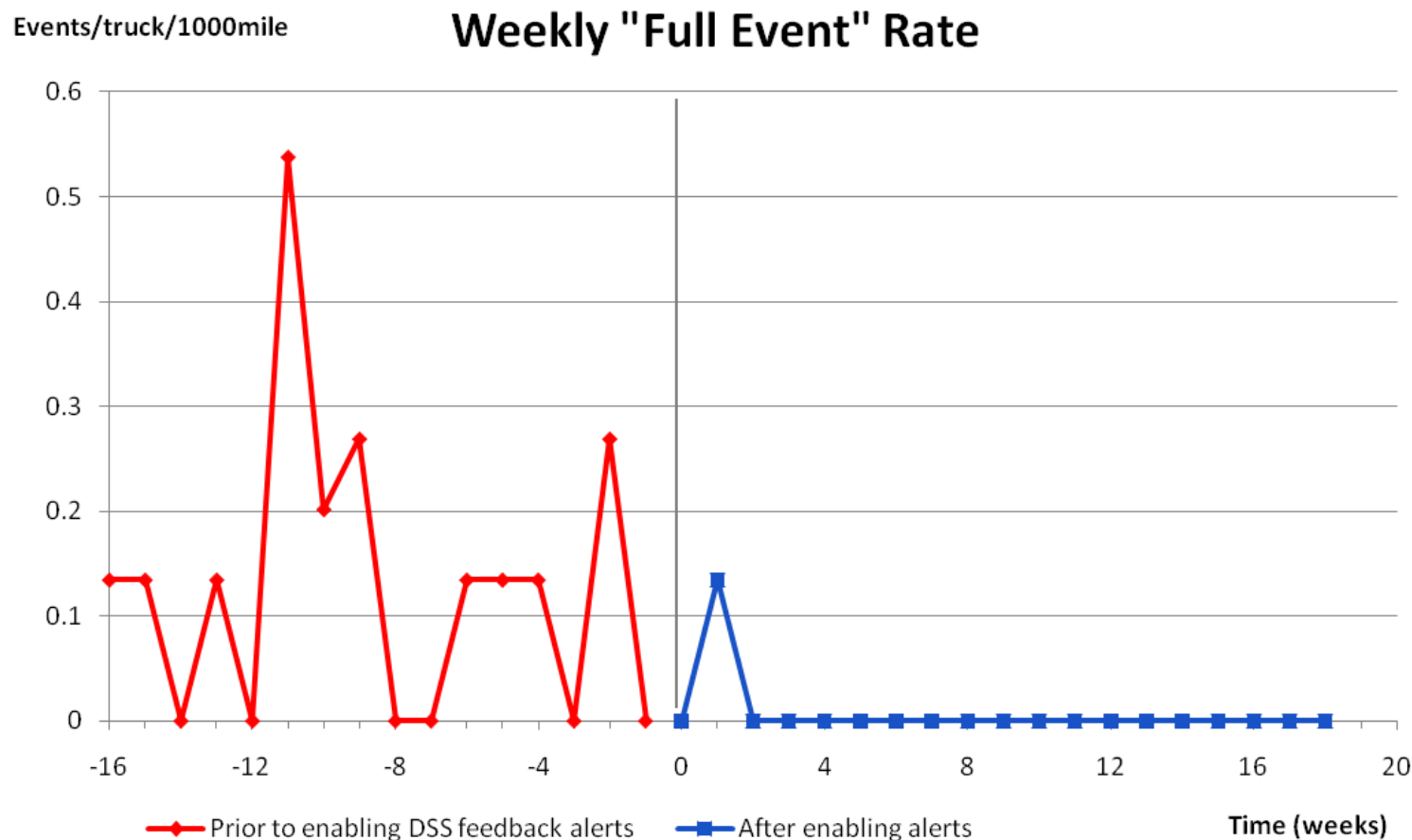
- 78% reduction in the distraction event frequency
- ~550 distraction events / 10,000 miles

Driver Drowsiness Events



- Small reduction in the drowsiness event frequency
- ~3.1 microsleep events / 10,000 miles

Fleet Major Event Frequency Rates



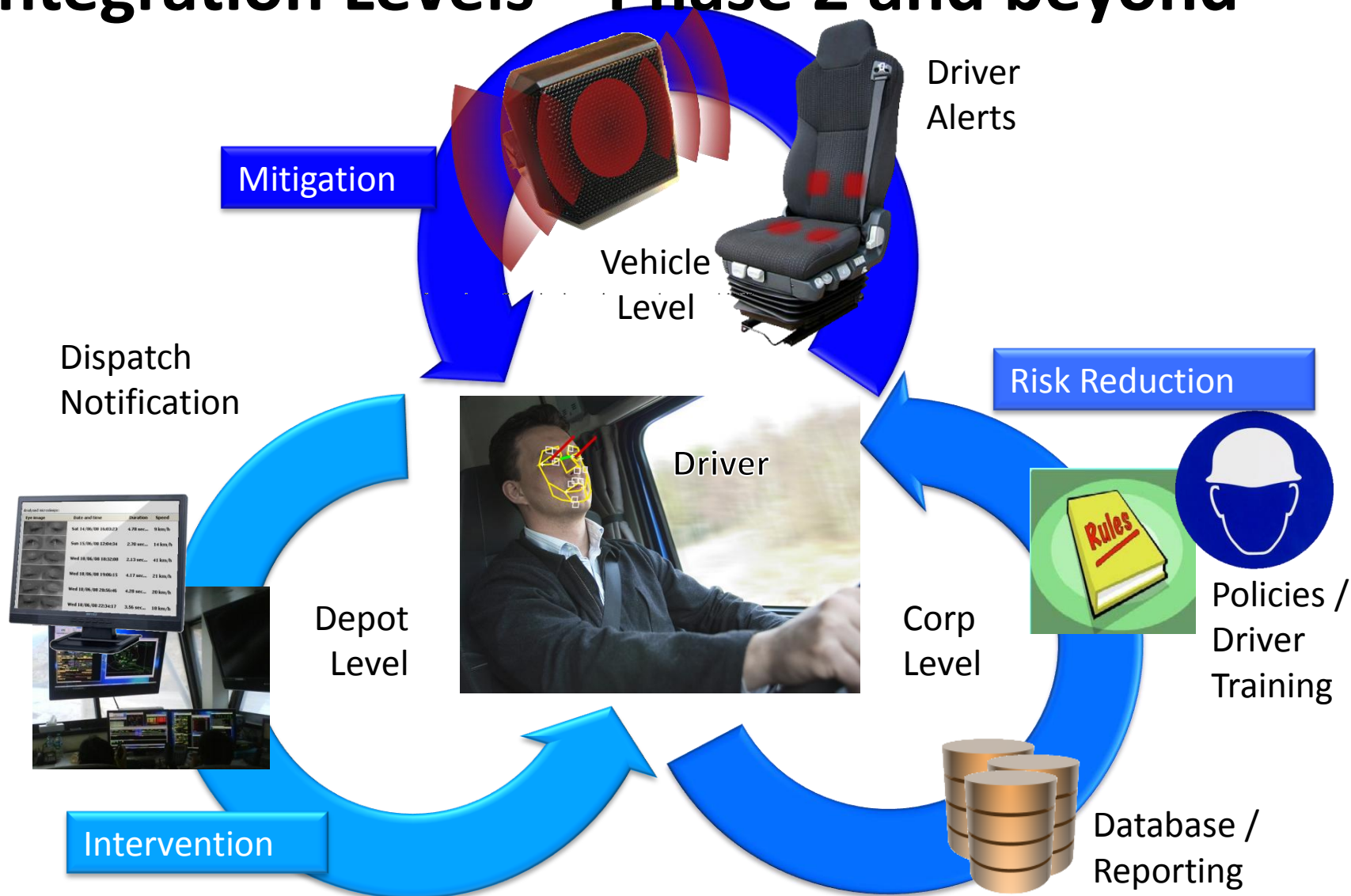
- 94% reduction in the “Full Event” rate → \$\$\$



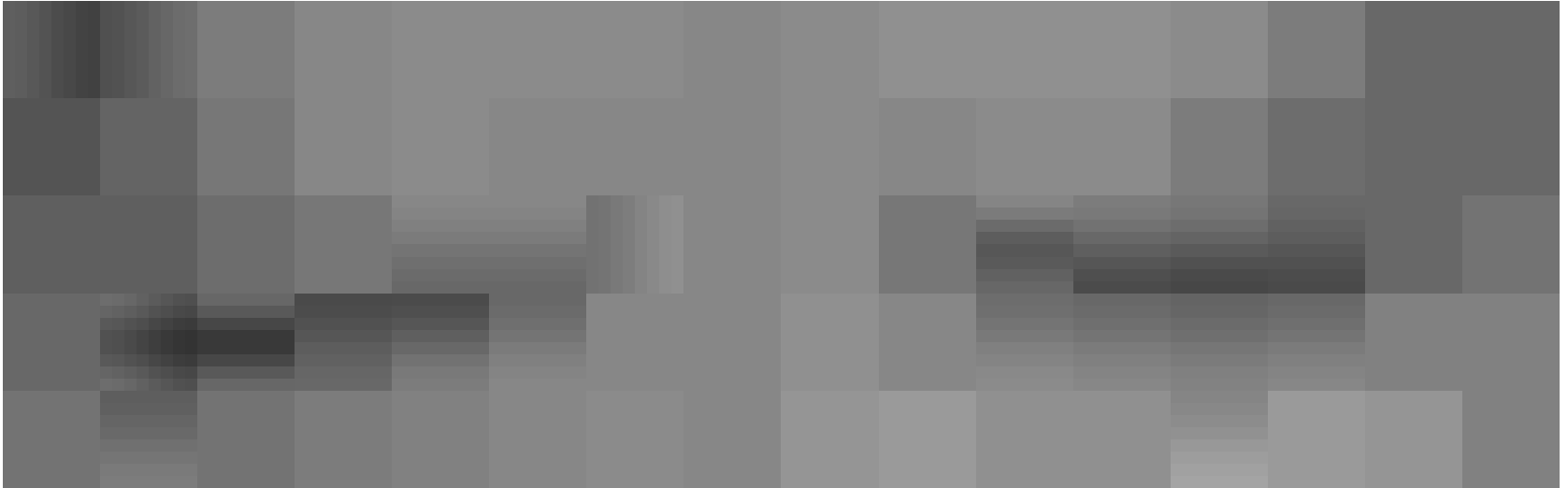
Tremendous driver buy-in

- Appropriate management attitude. Presented as safety tool – not a big stick/big brother
“help everyone go home safely every day”
- Drivers encouraged to improve & have embraced it
- Some driver feedback:
 - “This thing saved my life – I was not sure whether I was looking at a wild hog or a truck tire and the machine got me back on track (before I ran off the road)”
 - “5 yr old son diagnosed with ADD and having problems at school. Going to bed too late so changes made and now sleeping more and waking more rested (resulting from the Sleep Management Class)”
 - “8 month-old son so sleep at home is tough. Changed sleep cycles in job down time to sleep in 3 hr blocks, providing 2 sleep cycles.”
 - “More alert on a job, feel better overall, waking more rested & set alarm clock to coincide with sleep cycles.”
 - “This is pretty cool stuff – didn’t realize it was so good”
 - “When are we going to put this in all of the trucks at our depot?”

Integration Levels – Phase 2 and beyond



Thank you



Nick Cerneaz, CEO

nick.cerneaz@seeingmachines.com

www.seeingmachines.com

