Societal Costs of Road Transportation

Intelligent transportation systems (ITS) are designed to enable cooperation between vehicles and road infrastructure, using state-of-the-art CAV applications, to achieve improvements in safety, mobility and the environment.

Accidents

In Europe, there were over 38K fatalities and 1.7M injuries caused by auto accidents with 93% due to human error.

In the US, there were over 35K fatalities and 6.3M accidents in 2015 costing the US over $720B.

It is estimated that V2V communications can address 79% of accidents, while V2I communications can address 26% of accidents and, combined, they can address 81% of all accidents.

Traffic

In Europe, 1% of GDP is lost to congestion annually.

In the US, 6.9B hours are lost annually in traffic with urban congestion costing the US $160B annually.

Estimates indicated that connected vehicle dynamic mobility applications can eliminate one third of travel delay caused by congestion and improve freight deliver times by over 20%.

Environment

In the US, transportation contributes 56B pounds of carbon dioxide a year.

3.1B gallons, or over $6.5B, of fuel are wasted annually due to congestion in the US.

ITS could achieve a 2 to 4% reduction in oil consumption and related greenhouse gas emissions each year over the next 10 years.

Source: US Department of Transportation
Who is Cohda?

Cohda Wireless is the leading software and sensor supplier for the CAV and Smart City markets with a vision to make driving safer, more enjoyable and with less impact on the environment.

Mission Statement

License innovative, world leading Connected Autonomous Vehicle (“CAV”) solutions to Tier 1 automotive suppliers, ITS Equipment Vendors and METS vendors.

Cohda in Brief

- Hardware agnostic, leading supplier of software for the CAV market
- An innovative localization product with application to CAVs, underground mining and indoor retail
- Software proven to work on 5G networks, Wi-Fi and DSRC
- Strong patent portfolio with over 54 granted patents and 51 applications under examination
- Proven scalable platform proven to offer more performance in over 100,000 km of testing in live, zero-tolerance conditions
- Over 65% of vehicles in V2X trials use Cohda solutions and it is the only solution currently in production with an OEM
- Working with 600+ customers, including ongoing CAV trials and several Smart City deployments already in place
- Engineering team of 30+ experienced PhDs and engineers
Cohda’s Sectors

Cohda has applications across a multitude of markets, but is concentrated on the fastest growing segments of the Autonomous Vehicle and Smart City markets.

Cohda’s Smart City architecture allows cities preparing for a CAV future to leverage the infrastructure already in place enabling an array of applications.

Cohda’s range of foundation applications can be deployed today and have been shown to provide immediate benefits reducing congestion and improving travel time.

Cohda Wireless is a global leader in the mobile outdoor communications.

Already solved fundamental communication issues such as CAV localization, sensor fidelity and system cost

Preparing the next generation of CAV application layer software.

Cohda’s hardware-agnostic V2X stacks are used in more than 60% of all connected vehicle trials worldwide.

Backed by more than 100,000 km of real-world testing

OEM supplier of choice for production vehicles

Selected for the world’s first, and second production deployments.

Cohda delivers industry-leading connectivity solutions for the mining industry, improving safety and productivity in challenging environments.

Enables vehicles to operate autonomously in GNSS-denied locations.

Autonomous vehicles in mining operations can boost productivity 15-20%, according to research trials.
## Cohda’s Product Portfolio

Cohda has developed a hardware agnostic software solution that is enabling hardware products to communicate in the fast developing autonomous vehicle market.

### On Board Unit (“OBU”)
- Mature products, ready to be used in large scale field trials and aftermarket deployments
- Small, low cost module
- Powerful processor running V2X software stacks and applications
- V2X security with hardware acceleration and tamper-proof key storage
- Based upon the automotive-grade RoadLink™ chipset developed by NXP and Cohda
- Unmatched radio performance in harsh outdoor environments

### Road Side Unit (“RSU”)
- Similar functionality as the OBU
- NEMA4 weather-proof enclosure with integrated antennas and a mounting kit
- Dual antennas to maximize range and coverage
- Covers all the approaches to an intersection with just a single, self-contained unit
- Available in both mains and power over Ethernet power options

### Software: V2X-Stack
- Mature, hardware-agnostic V2X applications and stack
- Most deployed stack in this rapidly evolving sector with 60% market share
- Supports wireless 802.11p and 5G mobile networks
- Synthesizes data from nearby vehicles and roadside infrastructure to create broader zones of awareness
- Cohda software has been deployed over DSRC & LTE trials & C-V2X

### Software: CAV Applications
- Solves critical CAV issues including localization, sensor fidelity and system cost
- Improves driving environment monitoring through V2X radar
- Optimizes traffic efficiency through cooperative cruise control
- Expands driving tasks through accurate positioning
- Better data collection

### Chip Set Solution
- Cohda is experienced in the development of automotive grade SDR firmware
- Porting of software to multiple chip set vendors

### Cohda’s Product Portfolio

- Cohda Wireless Pty Ltd. All right reserved
Cohda’s V2X Stack

The Cohda ecosystem is setting the benchmark for the industry and is trusted by major car manufacturers, Smart Cities and mining companies, with over 600 clients already deploying Cohda solutions.

Cohda’s V2X solutions support wireless 802.11p and 5G mobile networks to provide cars with 360 degree awareness, detecting hidden threats beyond anything a driver or on-board sensors can see.

- Support for NXP, Autotalks, Renesas and Qualcomm chipsets
- Gathering and synthesizing data from nearby vehicles and roadside infrastructure creates a much broader zone of awareness, setting Cohda Wireless apart from its competitors
- Three Categories in the Ecosystem:

  1. **Applications Layer**
     The applications layer is the top-level applications suite which provides information, alerts and warnings to drivers.

  2. **Facilities Layer**
     The Facilities layer provides facilities to applications for such things as vehicle position, vehicle state, message set dictionaries, Car-to-Car message transmission and reception and threat detection.

  3. **Network Layer**
     The Network layer is comprised of standard compliance stack such as IEEE 1609 and ETSI TC–ITS applications.
Cohda’s Technology Stack

Choosing to develop within the Cohda eco-system means that you are working with a solution backed by more than one million vehicle-days of testing, and applications that are the industry standard for V2X product development.

Software Stack Licenses

1. Applications Layer
   - Top-level applications suite which provides information, alerts and warnings to drivers

2. Facilities Layer
   - Provides facilities to applications for things such as vehicle position, vehicle state and threat detection

3. Network Layer
   - Standards compliant products such as IEEE 1609 and ETSI TC-ITS stacks
   - Supports multiple DSRC and C-V2X chipsets

Virtual Machine

4. MKx SDK
   - Software Development Kit
   - Virtual machine that allows users to compile and run applications on MKx hardware

Hardware

5. MK5-OBU
6. MK5-RSU
7. MK5-XBU

Chip Set Solution provides V2X optimized solutions in any automotive-grade software defined radio chip (NXP, Renesas, Autotalks, 4G and 5G chips, etc)

MK5-OBU and MK5-RSU and MK5-XBU are ready-to-use
The Cohda Mobility MKx SDK is a software development kit enabling modifications and customizations of Cohda’s robust ecosystems.

The embedded Linux devkit allows for the running and compiling of applications on Cohda’s MKx family of products. Both Linux & QNX targets supported.

It includes software (source and binaries) necessary to modify and rebuild the MKx firmware to your specifications.

The SDK includes an emulation environment that allows the development of applications in the absence of hardware.

The emulation environment is a virtual machine, allowing the applications to be built, run and debugged on any PC.

Key Features

- Communications Services are looped back at the bottom of the IEEE 1609.4 layer, allowing IEEE 1609 message transmission and reception to be tested.
- NEMA log files can be replayed by the time / position services, allowing applications that use GPS to be tested.
- Controller Area Network (CAN) bus log files can be replayed by the Vehicle Interface Services, allowing applications that read CAN messages to be tested.
- Applications that use the user interface services can be tested using the video and audio of the virtual machine.
**Standards & Technologies**

*Cohda development team consistently designs to meet industry standards to ensure technology advancements meet and exceed market needs.*

<table>
<thead>
<tr>
<th>US Standards</th>
<th>EU Standards</th>
<th>APAC Standards</th>
</tr>
</thead>
</table>
| • IEEE 802.11p*  
• IEEE 1609 WAVE*  
• SAE  
  • DSRC Technical Committee  
  • DSRC Vehicle Safety Subcommittee  
• Coexistence  
  • IEEE 802.11 DSRC Coexistence Tiger Team  
  • ITS America DSRC Coexistence Consortium  
• USDOT PlugFests  
  • Attended all to date  
  • Passed 100% of the test scheduled in October 2017 plugfest  
| • ETSI C-ITS G5*  
• C2C-CC Member  
  • Active in WG-COM  
• ETSI Member  
  • Active in WG4  
• ETSI PlugTests  
  • Attended all to date  
  • Best mobility performance on MK5 hardware  
| • IEEE 1609 WAVE  
• ETSI C-ITS G5  
• Country specific adaptation (compatible with the Korea trial requirements, 3000 vehicle deployed with Cohda stack)  

Cellular

• 3G, 4G/LTE  
• 5G, 3GPP compatible, C-V2X feature  
  • US  
  • EU  
  • APAC  

* PICS list available on demand
Cohda Solutions

Cohda offers the most extensive solutions available to transform our cities and highways, delivering improved safety, and reducing congestion and emissions for a safer, more efficient and environmentally sustainable transport system.

CAV Apps
- Hardware-agnostic CAV software apps
  - Application Layer software for CAV Localisation
  - CAV Sensor Fidelity
  - “Day 2” and beyond V2X connectivity for CAVs.

Smart Cities
- Software to run on Intelligent Transport System (ITS) infrastructure to support CAVs in Smart Cities

V2X Stacks
- Network Layer
- Facilities Layer
- “Day 1” Application Layer software for both manual and autonomous vehicles.

Mining
- Software to enable proximity detection and collision avoidance for both manual and autonomous vehicles in mining.
To realize the true potential of the upcoming Connected Autonomous Vehicle revolution, CAV’s will need to communicate both with other vehicles and with smart city infrastructure.

Cohda’s next generation of CAV application layer software is giving car manufacturers key solutions to push CAV projects forward such as; Improving driving environment monitoring through V2X radar, optimising traffic efficiency through cooperative cruise control, improving driving tasks through accurate positioning and developing better performance data collection.

Deploying tomorrow’s CAV projects today.

**Solutions:**
- CAV Apps
- V2X-Locate
- V2X-Radar
CAV Solutions: Applications

Connectivity is the key to safer, smarter and greener transportation infrastructure and Cohda is leading the way

CAV App Description

- Cohda’s mature suite of CAV-specific applications have solved critical CAV issues including localization, sensor fidelity and system cost
- The next generation of CAV application layer software provides car manufacturers with advanced cooperative perception solutions:
  - Green Light Optimized Speed Advise (GLOSA)
  - Platooning
  - Collision Avoidance
- Cohda’s applications include multiple world firsts for the CAV sector, such as vehicle localization that achieves sub-meter accuracy working on existing Wi-Fi, DSRC or C-V2X infrastructure and a passive radar system that uses Wi-Fi, DSRC or C-V2X signals to sense the environment
Cohda’s breakthrough positioning software achieves sub-meter location positioning and is over 275% more accurate than comparable GNSS solutions.

Vehicles are equipped with On-Board Units (OBU) that allow a vehicle to communicate with other vehicles, pedestrians, infrastructure and the cloud.

Infrastructure is supported by Road Side Units (RSU) which are typically installed by road authorities or third parties.

V2X-Locate uses ranging measurements to fixed RSUs to enable enhanced positioning accuracy.

A signal transmitted over a wireless channel can suffer from a multipath effect which is a propagation phenomenon that results in radio signals reaching a receiver by more than one path.

Multipath is typically due to signal reflection from objects in direct line-of-sight.

The multipath effect is the main cause of GNSS degradation.

Ranges from spatially separated RSUs are fed into Cohda’s enhanced V2X-Locate positioning engine to accurately position the vehicle.

Through the advanced processing capabilities of Cohda’s Software Defined Radio, the V2X-Locate solution is able to calculate a true line-of-sight path regardless of the existence of multipath signals.

Cohda’s proprietary positioning engine determines the true line-of-sight path in the OBU allowing the vehicle to know its position.

V2X-Locate fuses this with a state-of-the-art automotive grade GNSS module, achieving accuracy down to 91cm compared to 2.5m with GNSS alone.
CAV Solutions: V2X-Locate

Connectivity is the key to safer, smarter and greener transportation infrastructure and Cohda is leading the way

**V2X-Locate**

- V2X-Locate is unique to Cohda. It allows the vehicles to position itself with sub-metre accuracy relative to RSU’s, even in tunnels, underground car parks and urban canyons where GNSS alone is not sufficient. V2X deployment, vehicles equipped with OBU’s, while infrastructure is supported by installation of RSU’s.
- V2X-Locate uses ranging measurements to these fixed RSUs to enable enhances positioning accuracy.
- The ranges from spatially separated RSUs are fed into Cohda enhanced V2X Locate positioning engine to accurately position the vehicle. Through the advanced processing capabilities of Cohda’s software designed radio the V2X Locate solution is able to calculate a true line-of-sight path regardless of the existence of multipath signals.
- Cohda’s V2X Locate positioning system with sub-meter accuracy, over 275% more accurate than comparable GNSS solution.
- Performance exceeds SAE J2945 requirements (68% < 1.5m)

**V2X-Locate NYC 6th Ave Test Bed**

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>67cm</td>
</tr>
<tr>
<td>90</td>
<td>77cm</td>
</tr>
<tr>
<td>95</td>
<td>83cm</td>
</tr>
</tbody>
</table>

Percentile Error:

- 68: 67cm
- 90: 77cm
- 95: 83cm
**CAV Solutions: V2X-Radar**

Cohda’s V2X-Radar is a game-changing product that will deliver value for drivers of V2X-equipped vehicles, particularly in the early days when the penetration rate of V2X connected vehicles is low.

<table>
<thead>
<tr>
<th>V2X-Radar Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2X-Radar uses standard V2X radio signals to sense the surrounding environment, transforming a standard V2X communications system into a 360 degree car radar</td>
</tr>
<tr>
<td>V2X-Radar takes advantage of current V2X systems to detect radio signals as they bounce off objects (walls, road signs and other vehicles) while travelling from transmitter to receiver</td>
</tr>
<tr>
<td>By knowing the position of the transmitter, the receiver and the environment, V2X-Radar can use the radio waves to identify objects within that environment, including non-V2X equipped vehicles</td>
</tr>
<tr>
<td>Cohda’s V2X-Radar delivers a new 360 degree sensor that can detect buildings, road signs and older vehicles while being unaffected by rain, snow or fog</td>
</tr>
<tr>
<td>V2X-Radar is a passive radar system that can use DSRC, Wi-Fi, C-V2X, or LTE signals as illuminators</td>
</tr>
</tbody>
</table>
The cities of the future need to be connected, supporting collaborative technology to make them safer and more productive.

Cohda’s Smart City CAV Architecture uses foundation applications (such as Green Wave and Signal Priority) deployed to niche fleets (such as heavy vehicles, transit vehicles, and taxis) to directly impacting safety, congestion and pollution.

Cohda’s Smart City infrastructure not only offers immediate benefits today, but makes roads CAV ready. Cohda’s Smart City infrastructure provides the fundamental infrastructure enabling the cars of tomorrow to drive with the infrastructure of today.
### Applications

More than 60 Applications like
- Hazard Location Warning
- Road Work Warning
- Green Light Optimization Speed Advisory
- Signal Violation Warning (red light violation warning)
- In-Vehicle Signage
- Curve Speed Warning
- Ice Road Warning
- SCMS/PKI Interface
- Vehicle Situation Awareness
- Speed Compliance (SC, SPD-COMP, SPD-COMP / Work Zone)
- Oversize compliance
- Evacuation Notification
- Freight Signal Priority
- Transit Signal Priority
- Platooning

### Deployments

- C-Roads (Europe)
- Transport for NSW CITI trial
- Freight Signal Priority PoC in Sydney
- CITE Project (UK)
- C-ITS Corridor (NL/D/A)
- French SCOOP@F
- Safety pilot/ AAVTE
- Connected Vehicle Pilots: Wyoming, NY City - [example](#)
- Smart City- Columbus, Denver, Austin
- European Truck Platooning Challenge
- Trial: Peloton Platooning – [example](#)
- Trial: TfNSW Freight Signal Priority - [example](#)
Peloton Platooning Deployment

Cohda is proving V2V solutions to OEMs through truck platooning research and by providing the V2V connectivity that enables Peloton – the world’s first truck platooning deployment

- Peloton is an automated vehicle technology company hard at work solving the two biggest challenges facing the $700 billion trucking industry: crashes and fuel use
- Trucks are connected using direct V2V communications allowing the rear truck to react immediately to the actions of the front truck
- By electronically coupling the trucks in this way, they accelerate and brake together and can safely operate at closer distances to form a platoon
- The Peloton System has proven savings of more than 7% when platooning using industry standard tests
  - 4.5% for the lead truck and 10% for the following truck
- Peloton selected Cohda to provide the V2V connectivity, which needed to be robust and reliable for trucks following closely at highway speeds
**New York 6th Ave.**

*Cohda working with NYC to prove out the value of V2X Locate in GNSS challenged environment...the Urban Canyon of 6th Ave, resulting in location accuracy of <1m 95% of the time.*

<table>
<thead>
<tr>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The utility of V2X Locate is particularly evident in GNSS challenged locations.</td>
</tr>
<tr>
<td>• V2X deployment, vehicles equipped with OBU’s, while infrastructure is supported by installation of RSU’s. V2X Locate uses ranging measurements to these fixed RSUs to enable enhances positioning accuracy.</td>
</tr>
<tr>
<td>• The ranges from spatially separated RSUs are fed into Cohda enhanced V2X Locate positioning engine to accurately position the vehicle. Through the advanced processing capabilities of Cohda’s software designed radio the V2X Locate solution is able to calculate a true line-of-sight path regardless of the existence of multipath signals.</td>
</tr>
<tr>
<td>• Cohda’s proprietary positioning engine determines the true line-of-sight path in the OBU allowing the vehicle to know its position with results: - GNSS performance significantly challenged - Cohda’s V2X Locate positioning system with sub-meter accuracy, over 275% more accurate than comparable GNSS solution.</td>
</tr>
</tbody>
</table>

**V2X Locate NYC 6th Ave Test Bed**
94 per cent of crashes involve human error, Cohda Wireless’s company mission is to make roads safer and better, not just for drivers but the most at risk; motorcyclists, pedestrians, and cyclists.

V2X not only has the ability to eliminate or reduce the severity of up to 80 percent of non-impaired-driving crashes, but it can reduce congestion and create greener more efficient transport systems.

Cohda’s SW is compatible with rel.14 3GPP

Cohda is working with all major cellular chip set suppliers
## V2X & C-V2X

### Applications

- More than 60 Applications like
  - Stationary Vehicle Ahead
  - Emergency Elect. Brake Lights
  - Intersection Collision Warning
  - Emergency Vehicle Warning
  - Traffic Jam Ahead
  - Forward Collision Warning
  - Blind Spot Warning
  - Lane Change Assist
  - Left Turn Assist
  - Motorbike Approaching Warning
  - Do Not Pass Warning
  - Curve Speed warning
  - Ice Road Warning
  - Rear-cross Traffic Assist
  - Transit Signal Priority
  - Green Light Optimized Speed Advisory
  - V2P Vehicle to Pedestrian

### Deployments

- 2017 General Motors Cadillac CTS - *example*
- 2017 O-Bahn Bus – *example*
- 2018 NVIDIA DRIVE™ - *example*
- 2019 VW Golf
- 2019 VW Passat
- 2019 3rd OEM (still under NDA)
- Ducati Digital Shield Pilot
- Jaguar Land Rover Autonomous Trial – *example*
- Telstra V2X over LTE Trial – *example*
Cohda’s V2X software enables cooperation between vehicles and infrastructure to improve safety and mobility and provide a positive environmental impact

- Cohda Wireless supplied General Motors with its industry leading DSRC solution, comprised of 10 DSRC V2X applications including intersection collision warning, hazardous location warning and emergency vehicle warning.
- The 2017 Cadillac CTS is the first OEM deployment of V2X technology and uses the Cohda-based DSRC solution and GPS to transmit and receive as many as 1000 messages per second from other vehicles as far as 300 meters away.
- Cohda’s V2X software provides 360 degree awareness by gathering and synthesizing data from sensors on nearby vehicles and roadside infrastructure to detect hidden threats by extending the horizon of awareness beyond what the driver can see.
Cohda Wireless has a proven suite of “Day One” applications that have become the industry standard in automotive V2X production and are already deployed on O-Bahn buses in Australia

- Cohda has deployed a V2X solution for 175 O-Bahn Buses in Adelaide, South Australia
- The V2X enabled buses are equipped with:
  - Collision avoidance on the track
  - Distance following warnings
  - Remote operation of boom gates
- Cohda has integrated V2X and Transit Signal Priority on Yarra Trams in Melbourne
- Cohda is a Member of the iMOVE CRC, an Australian Cooperative Research Center focused on ITS for transport and mobility
- Cohda is also a member of the Australian Integrated Multimodal Ecosystem (AIMES) Test Bed for buses, trams and autonomous vehicles
Jaguar Land Rover Trial

With a proven suite of CAV products focused on the platooning of autonomous vehicles, Cohda is leading the way in fully autonomous off-roading

- Land Rover is creating a fleet of 100-plus research vehicles, with the aim of making fully autonomous off-roading the new norm
- Land Rover was eager to explore how connectivity would play a part in the future of four-wheel-driving
- The multi-million dollar autonomous all-terrain driving research project envisaged a self-driving car that can navigate both on-road and off-road, as well as in difficult weather conditions
- The key to success was Cohda’s MK5 On-Board Units and software
- The Cohda-enabled wireless V2V communications system instantly shares information such as vehicle location, wheel-slip, changes to suspension height and wheel articulation, as well as All-Terrain Progress Control and Terrain Response settings between the two vehicles

Overview

Land Rover Off Road Connected Convoy

- Range Rover Off Road Connected Convoy Pilot
Cohda’s V2X software stack expands the abilities of a vehicle to allow it to detect threats beyond line-of-sight by fusing V2X with video-based target classification on an NVIDIA platform.

- The NVIDIA DRIVE platform combines deep learning, sensor fusion and surround vision to enable autonomous driving.
- The system is capable of understanding, in real time, the surroundings around the vehicle, precisely locating itself on a HD map and planning a safe path forward.
- Cohda’s V2X solutions, which support both wireless 802.11p and 5G mobile networks, provide cars with hidden threat detection by extending the horizon of awareness beyond what the driver can see or on-board sensors can detect.
- The integration of Cohda’s V2X solutions to NVIDIA DRIVE’s system strengthens its ability to see beyond the vehicle-centric perspective by gathering and fusing data from sensors on nearby vehicles and roadside infrastructure – creating a much broader zone of awareness.

<table>
<thead>
<tr>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The NVIDIA DRIVE platform combines deep learning, sensor fusion and surround vision to enable autonomous driving.</td>
</tr>
<tr>
<td>• The system is capable of understanding, in real time, the surroundings around the vehicle, precisely locating itself on a HD map and planning a safe path forward.</td>
</tr>
<tr>
<td>• Cohda’s V2X solutions, which support both wireless 802.11p and 5G mobile networks, provide cars with hidden threat detection by extending the horizon of awareness beyond what the driver can see or on-board sensors can detect.</td>
</tr>
<tr>
<td>• The integration of Cohda’s V2X solutions to NVIDIA DRIVE’s system strengthens its ability to see beyond the vehicle-centric perspective by gathering and fusing data from sensors on nearby vehicles and roadside infrastructure – creating a much broader zone of awareness.</td>
</tr>
</tbody>
</table>
Telstra V2X over LTE Trial

Cohda, in conjunction with Telstra, is playing a pivotal role in developing CAV technologies over 4G and 5G networks

- Telstra believes its 4G and future 5G networks can play a vital role in supporting the faster rollout of intelligent transport systems and Connected Vehicle applications, making implementation of the technology cheaper and more efficient
- The South Australian trial confirms that 4G can support Connected Vehicle applications, which include:
  - Alerting a driver to roadworks ahead
  - Giving green light priority to high priority vehicles
  - Optimal green light timing, where the vehicle is informed of the optimal speed to approach a traffic light to get a green light when they arrive, therefore allowing a more continuous flow of traffic
- Cohda, in partnership with Telstra, successfully trialed Cohda’s Connected Vehicle technology over Telstra’s 4G network in South Australia, a pivotal first step in developing CAV technology
ATP Automotive Testing Papenburg GmbH operates one of the largest and manufacturer independent automotive proving grounds for passenger and commercial vehicles in the world.

- ATP has replaced their proprietary traffic control system with state of the art V2X using Cohda Wireless technology.
- 30 RSU are installed on the track with 100% coverage.
- In each car an OBU will be installed. In total 400 OBUs will be used.
- The OBU reports the current position and in combination with the FCW the driver receives a warning about possible collisions.
- Traffic Control Center software will be developed by ATP.
- ATP is very interested using V2X Locate for improving positioning as soon as they have the base system running.
As mining companies constantly seek a competitive advantage in a price sensitive industry, research shows that autonomous vehicle operations can increase productivity by 15 to 20 per cent and truck uptimes by up to a fifth.

Cohda Wireless has developed a range of mining specific solutions that offer safety and productivity solutions today, but pave the way for the autonomous mines of tomorrow.

Solving major subterranean positioning problems facing the industry. Cohda Wireless has become the supplier of choice to METS and mines.
### Mining

#### Applications

More than 20 Applications like
- Proximity and Collision Warning
- Forward Collision Warning
- Intersection Collision Warning
- Emergency Electronic Brake Light
- Hazardous Location Warning
- Stationary Vehicle Ahead
- Emergency Vehicle Warning
- Road Side Alerts
- In-Vehicle Signage
- Virtual Traffic Signal
- Clear Path Ahead
- Vehicle Location
- Personnel Location
- Asset Location

#### Deployments

- Rio Tinto Kennecott, Utah - *example*
## Rio Tinto Underground Trial

*Cohda is playing a pivotal role in developing underground positioning technologies and applications*

<table>
<thead>
<tr>
<th>Overview</th>
<th>Kennecott Utah Copper (KUC) Trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cohda’s V2X Locate technology proving that it plays a vital role in supporting operations underground - reducing accidents and improving productivity</td>
<td></td>
</tr>
<tr>
<td>• The KUC trial confirms that V2X Locate can support standard surface applications optimized for underground tunnel use, which include:</td>
<td></td>
</tr>
<tr>
<td>• Proximity and Collision Warning</td>
<td></td>
</tr>
<tr>
<td>• Forward Collision Warning</td>
<td></td>
</tr>
<tr>
<td>• Variable Speed Warning: where the speed limits can be set by the operational team for particular sections in the underground mine tunnel</td>
<td></td>
</tr>
<tr>
<td>• Cohda, in partnership with Roobuck, also successfully trialed Cohda’s mining units MK5 XBU with equipment tags and personnel tags</td>
<td></td>
</tr>
<tr>
<td>• Fully functional proximity warning during network backbone power failure</td>
<td></td>
</tr>
</tbody>
</table>
Contact Us

Cohda Wireless Pty Ltd (Headquarters)
27 Greenhill Road
Wayville, SA 5034
Australia
Phone: +61 8 7099 5500
inquiry@cohdawireless.com

Cohda Wireless Europe GmbH
Kronstadter Str. 4 81677
Munich
Germany
Phone: +49 89 208026548
Fax: +49 89 208026600
inquiry.eu@cohdawireless.com

Cohda Wireless America LLC
3135 South State Street, Suite 102,
Ann Arbor, MI 48108
USA
Phone: +1 248-513-2105
Fax: +1 248-848-7625
inquiry.na@cohdawireless.com

Cohda Wireless Connected Vehicles (Shanghai) Trading Company Ltd
上海市 普陀区 岚皋路567号8座 1107室
Room 1107, Building B,
567 Langao Road
Putuo Area, Shanghai
People’s Republic of China
Phone: +86 21 2221 8265
Fax: +86 21 2221 8377
inquiry.ch@cohdawireless.com

Korea (Office/Partner)
Hancom MDS Inc. 3,4Fl. Hancom Tower, 49
Daewangpangyo–ro 644 Beon–gil Bundang–gu
Seongnam–si, Gyeonggi–do
13493,
Republic of Korea
Phone: +82 31-627-3000
Fax: +82 31-627-3100
inquiry.kr@cohdawireless.com

Japan (Office/Partner)
2-3-13, Konan, Minato-ku
Tokyo, 108-8510
Japan
Phone: +81 3-5462-9724
Fax: +81 3-5462-9699
inquiry.jp@cohdawireless.com