CAVCOE

CAV Update

A monthly newsletter on the CAV ecosystem

May 2023

From the Editors

The current and future deployment rates for passenger CAVs vary according to how complex the use-case is. Robotaxis are in use today, some of them in commercial services. These tend to be in urban areas that are geographically fenced and have been subjected to high-definition mapping. And then there are edge cases that are far more challenging for CAVs; an article below describes one such case in San Francisco when fog rolled in. Another article in this issue describes how data from CAVs in edge-case situations is far more useful to CAV developers than routine driving data.

All this came to mind when Barrie Kirk and his partner were on a recent visit to England and spent part of the time driving in Cornwall, especially in the area of *Port Isaac* (better known as *Portwenn* to viewers of the UK TV series *Doc Martin*.) In this part of Cornwall, and in many other parts of the UK, there are 2-way rural and village roads that are barely wide enough for 1 car. When 2 cars driving in opposite directions meet, there are two options. Either the cars drive onto the bank at the side of the road so they can pass each other with the hedge scraping the side of the car, or one of the cars has to reverse to a place where they can pass.

This is definitely another edge case situation and I doubt that CAVs with AI will be able to deal with this any time soon.

On a different subject, I want to give a big shout-out to **Ahmad Radmanesh**, CAV Update's Chief Editor. Ahmad has had this role for 5 years now and has done a wonderful job of tracking all the CAV developments and producing this newsletter. Many thanks for all your excellent work, Ahmad!

Canadian CAV News

CSA Group has released a new research report titled: *Accessibility and Connected & Automated Vehicles: Challenges and Considerations*. The report provides an overview of the current North American legal and technical standards landscape for accessibility that may apply to ride-sourcing services that use CAVs instead of human-operated vehicles. The report can be viewed at this link.

While the media and the public imagination are captured by *Artificial Intelligence* (AI) these days, Toronto-based **Waabi** has gone the other way; by tapping into natural *Human Intelligence*. Waabi has achieved this by enlisting the help of a few very experienced truck drivers working in Canada and the U.S. Some of these drivers have had 3 million miles (4.8 million kilometres) or more behind the wheel of a truck. Waabi started this consultation with the truck drivers in early March 2023. The effort is dubbed the *Million Mile Driver Advisory Board*. The advice from lived experience of these drivers will be incorporated into *Waabi Driver* software which powers Waabi's automated trucks. **MIT's** *Center for Transportation and Logistics* was also a participant in this exercise as a moderator and research organization, More information is at Waabi's site at this link. A short YouTube video of the driver participants can also be viewed at this link.

In previous editions of this newsletter, we had reported on some **Tesla** owners putting their vehicle's *Full Self-Driving* (FSD) system to work in an urban environment. We reported on FSD in action in the cities of Medicine Hat, Alberta (June 2022) and St. John's, Newfoundland (May 2022), The latest demonstration of FSD's capabilities occurred in downtown **Ottawa** on May 1, 2023. The owner of the Tesla made a 29-minute video of his automated drive in various parts of downtown and posted it on YouTube. There were a few occasions when the driver had to take control to prevent the Tesla doing something unwanted (e.g. driving into an underground garage), or to prevent it from hitting other objects on the road, The YouTube video along with the driver's comments can be viewed at this link.

Many of the most intractable issues in the CAV ecosystem have to do with government regulations of automated driving. Perhaps the most notable are liability issues governing the operation of CAVs at scale. An 82-page report published jointly by Toronto-based **Hatch** and the **Urban Robotics Foundation** addresses these issues in great detail. Titled *The Driverless Endgame: Policy and Regulation for Automated Driving*, the report examines a wide variety of regulatory issues, offers

suggestions, and makes 42 recommendations to regulators to enable driverless vehicles to deploy quickly at scale without compromising safety. The report also includes a section dedicated to *Public Mobile Robots* (sidewalk robots) which are an important part of the non-passenger AV ecosystem. More information as well as a free copy of the report may be found at this link.

International CAV News

Pittsburgh-based **Koop Technologies** is a new type of insurance company specilizing in insuring automated systems such as autonomous vehicles as well as off-road applications in robotics, agriculture, construction, mining, warehousing, manufacturing and aerial use cases. The evolution of AVs and AV companies has created a new market for specialized insurance products to address the requirements of this specific industry. As AV companies move from testing and development to commercialization, their insurance needs will change as the risk will change when paying passengers are involved. Unlike traditional insurance companies, Koop's personnel includes people with experience in autonomous vehicle engineering, systems safety, data science as well as people with expertise in insurance and risk management. More information is at this link. The link also contains a 48-minute audio interview with Koop's CEO about the company and its various insurance products.

Porsche Engineering is a wholly owned subsidiary of **Porsche AG** of Germany. Porsche Engineering is actively engaged in developing V2X connected vehicle technologies using 5G communication technologies. A detailed article in *testing-simulation.com* describes some of Porsche's efforts in this regard. To this end, Porsche Engineering develops both hardware and software at multiple locations. It also has access to a closed 700-hectare test facility equipped with a private 5G network. The site includes a 12.6 Km track where tests are conducted at various speeds to determine the reliability of data exchange at speeds of up to 200 Km/h or higher. In the future, it is expected that vehicles will remain in constant contact with each other and their environment through V2X, The article can be viewed at this link.

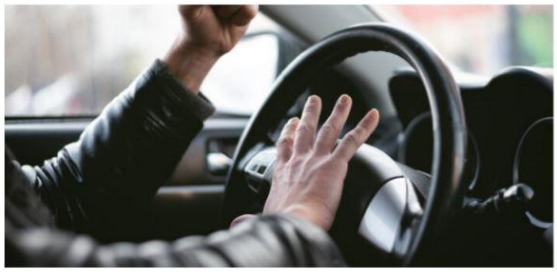
One of the challenges of deploying AVs at scale is how a mix of AVs and human-driven cars can co-exist in an urban environment. While dedicated *AV Lanes* have been proposed by some authorities, these are disruptive and come with a high cost. A paper published in March 2023 by the **Institute of Electrical & Electronics Engineers** (IEEE); proposes the novel idea of adding a *White Light* to the familiar tri-coloured traffic signals to ease the transition from conventional cars to AVs. Through a *vehicle-level distributed coordination strategy*, a mixed traffic stream of connected automated vehicles (CAVs) and connected human-driven vehicles (CHVs) can work with each other for going through signalized intersections. Approaching CAVs coordinate their actions as they approach signalized intersections when the conditions are right and trigger the *White Light* phase of the traffic signal. Under these circumstances, CHVs will simply follow the car in front to go through the intersection. Extensive simulation studies by the researchers indicate that the scheme is feasible and will result in less delays and reduced fuel consumption of emissions. More information is at this link.

It is common knowledge that most neural network-based artificial intelligence systems are trained on large datasets to be able to recognize speech or images with a high degree of reliability. New research at the **Massachusetts Institute of Technology** (MIT) has tapped the potential of a new technology known as *liquid neural network* to extend the established systems of training an AI. It is reported that the new technique enables autonomous systems such as an autonomous drone to be able to navigate; with high degree of accuracy the terrain that it has not been trained on. For example, if the drone had been trained to detect wildfires in a forested area, the new technology enables it to also recognize fires in an urban area. The researchers claim the technology can have application for autonomous vehicles as well as other automated systems such as parcel delivery by drone and firefighting, More information is at this link. The full MIT paper (published in April 2023) can also be viewed at this link.

Following the trend by developers of automated trucking companies, **TuSimple Holdings, Inc.** - the one-time leader of this industry has fallen on hard times, so much so that it may be delisted by the *NASDAQ* market due to its falling share price (under one US dollar as of this writing); and the tremendous loss in market value (a drop of over 97%), At its peak in July 2021, TuSimple enjoyed a market capitalization of nearly US$15 billion. Its current market cap is about US$264 million. The company has also laid off a significant number of its staff. Other autonomous truck developers **Embark Trucks** and **Starsky Robotics** have suffered the same fate, with Embark announcing in March 2023 that it is shutting down and Starsky announcing it was going out of business as of March 2020, More information is at this link.

It is a well-known fact that one of the major challenges in AV development is the ability to properly deal with *edge cases*, i.e., circumstances that occur on rare occasions. Such an *edge case* occurred for a **Cruise** driverless vehicle in San Francisco on March 23, 2023. The result was that the Cruise vehicle rear-ended a city transit bus at a slow speed of about 10 MPH (16 Km/h), No significant damage or injuries were caused by this collision. Cruise initiated an immediate investigation, discovered the root cause, and completed the required software modification. It then updated 300 of its vehicles with the new software on March 25, 2023. As is required by law, it also filed a *voluntary recall report* with the **National Highway Traffic Safety Administration** (NHTSA) after the work was done. Cruise's CEO wrote a narrative about this incident which was posted on Cruise's website. The narrative can be viewed at this link. The actual NHTSA filing dated April 3, 2023 can be viewed/downloaded at this link.

A recent paper published by the UK's **Warwick University** titled *The relationship between aggressive driving and driver performance: A systematic review with meta-analysis* does a deep dive into aggressive driving behaviour and envisions a future when self-driving cars and human-driven cars will have to share the same roads. The paper states that on an average day, 4 to 5 people are killed in the UK due to aggressive driving behaviour. In general, aggressive drivers are more erratic, driver faster, and make more mistakes than those drivers in a non-aggressive state. This puts other road users and pedestrians at risk while also creating a challenge for researchers developing self-driving car technology. The study at Warwick used a *driving simulator* where participants were asked to recall angry memories, putting them in an aggressive state, while performing a driving simulation. These were compared to a control group, who weren't feeling aggressive. More information is at this link. Warwick University's full paper can be viewed at this link.



The phrase *Data is the new oil* was first coined in 2006. It implied that like oil, data is valuable but if unrefined, it cannot really be used. In the early days, AV developers took this to heart and collected as much data from their test vehicles and simulations as possible. It appears that that thinking has now changed and leading developers such as **Waymo** and **Cruise** are more selective in what data they find valuable and worth storing, and what data they delete and discard. One reason is cost. For example, the annual cost of cloud storage on Amazon Web Services (AWS) for an AV

generating 4,000 GB of data per day can be as much as US$350,000 (at 2 cents per gigabyte). AV companies now discard data that contributes little to making their AI smarter, e.g., an AV driving on sunny clear day on a straight road with little traffic. By contrast, data for rare occurrences (*edge cases*) is considered high value and worth keeping. More information is at this link,

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And finally, it is common knowledge that most of AV testing is done in warm sunny locales where there is little or no inclement weather. An exception to this is the city of **San francisco** where both **Waymo** and **Cruise** have deployed a significant number of test AVs as well as driverless robotaxis for fare paying passengers. On the morning of April 11, 2023, a heavy fog descended on San Francisco. This caused five of Waymo's driverless vehicles to all stop on a busy residential street. One of them blocked the centre of the road making getting past them difficult for other drivers. No amount of drivers flashing their lights or honking their horns made the Waymo vehicles budge, Eventually, the fog lifted and the Waymo AVs continued on their journeys. This incident adds one more to a fairly long list of incidents caused by driverless AVs behaving erratically on San Francisco streets. More information is at this link and this one.

CAVCOE Speakers' Bureau

CAVCOE provides speakers for many different types of events across Canada, the US and overseas. On the one hand, our keynotes and presentations have core messaging on the status of CAVs, their deployment scenarios, and the impact on business plans, government regulations, and almost all aspects of society. On the other hand, each presentation is customized for the audience and the time available.

To enquire about a speaker for your event, please write to speakers@cavcoe.com

Upcoming CAV-Related Events

June 4-7, 2023	UITP Global Public Transport Summit, Barcelona, Spain
June 7, 2023	Area X.O webinar on "How to Reduce Time, Cost, Effort and Risk through Simulation"
June 7-8, 2023	AutoTech: Detroit, Suburban Collection Showplace, Novi MI, USA
June 12-15, 2023	Hexagon | AutonomouStuff News, Autonomy & Positioning Reality Summit, HxGN LIVE Global 2023, Las Vegas NV
June 14-16, 2023	ITS Canada 2023, Windsor ON
June 20-22, 2023	Autonomous Ship Expo and Conference, Amsterdam, The Netherlands
June 21-23, 2023	ADAS & Autonomous Vehicle Technology Expo, Stuttgart, Germany
June 27, 2023	Webinar on Public Mobile Robots by Urban Robotics Foundation
July 12-13, 2023	VTM Michigan Vehicle & Transportation Technology Innovation Meetings, Novi MI
September 20-21, 2023	ADAS & Autonomous Vehicle Technology Expo, Santa Clara CA
September 24-27, 2023	2023 Transportation Association of Canada (TAC) Conference & Exhibition, Ottawa, Ontario
October 19-20, 2023	Last Mile Delivery Conference & Expo (LMD-2023), Las Vegas NV
November 7-10, 2023	Aerial Evolution Association of Canada Conference & Exhibition, Ottawa, Ontario

About CAV Update

CAV Update is a free, monthly summary of news and analysis in the world of connected and automated vehicles, and their impact on the private sector, government, and society.

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***CAVCOE** (formerly the Canadian Automated Vehicles Centre of Excellence) advises the public and private sectors on planning for the arrival of self-driving vehicles.*

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