CASPI
CANADIAN AUTOMATED SNOW PLOW INITIATIVE

CAVCOE

CAV Update

A monthly newsletter on the CAV ecosystem

March 2021

From the Editors

As we look back at the twelve months since the COVID-19 era started, it is clear that there has been little or no impact on the CAV ecosystem. Which is both surprising and unsurprising. Surprising, because if is well known that COVID has negatively impacted so many aspects of the economy. Unsurprising, because the technology ecosystem – of which CAVs are a part – has not been affected as much as other sectors. The evidence for the lack of an impact includes the unchanging number of CAV-related stories in *CAV Update*, and closer to home, CAVCOE's volume of business has been excellent.

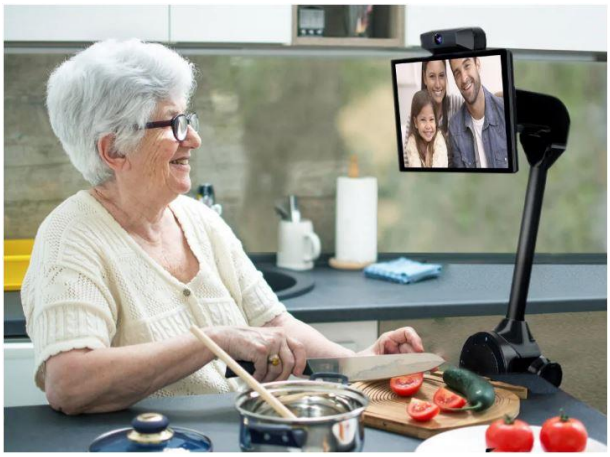
At the same time, we need to recognize that there are many parts of the economy – and very many people – who have suffered and still are, including healthcare, long term care, travel and transportation, hospitality, restaurants, and many other sectors. It has been a far longer battle than any of us expected, but the light at the end of the tunnel is getting brighter.

Canadian CAV News

Calgary-based **Pantala Technologies** has developed a pair of robots for deployment in hospitals, senior residences, hospitality industry, retail outlets and office environment. One robot named *Temi* is fully-autonomous and the other called *Ohmni* is semi-autonomous according to the company. It is stated that the fully-autonomous robot uses many of the same technologies, sensors, and software as those used in self-driving cars. These are relatively low-cost robots. The company website shows the base price of *Temi* as C$6,900 and that of *Ohmni* at C$3,700. More information is at this link. There is also a short YouTube video showing *Temi* in action. The video clip can be viewed at this link.

Temi Robot (Base model)

Ohmni Robot



Another Calgary-based company **Radley Robotics** has developed a simple *telepresence* robot based on an iPad. This robot has been deployed at a senior's residence operated by **Silvera for Seniors**. According to the company, its robotic system can provide an isolated senior with all the technology to stay connected — Zoom calls, Skype, FaceTime, computer access and contact with their loved ones — without the senior having to learn any new technology or touch a device. The device is currently rented at a rate of $75/day. The company hopes to expand the robot's use in private homes and add other functions to it. More information is at this link. CBC radio's 7-minute interview with the company founder – Savana Radley, can be heard at the bottom of the same link.

On March 10, 2021, **driving.ca** and **Toyota Canada** presented a one-hour webinar titled *When will autonomous cars be ready for Canada?* The panel of experts included Dr. Ryan Eustice, senior vice-president of Automated Driving at the Toyota Research Institute; Stefanie Bruinsma, University of Waterloo's industry engagement officer; Paul Rudy, co-founder and CMO of Kyocera SLD Laser; and Raed Kadri, head of Ontario's Autonomous Vehicle Innovation Network (AVIN). The experts shared their views on the realties and challenges of bringing AVs to the market. Toyota's approach is a gradual one to incorporate AI into cars in incremental steps, with the ultimate goal of reaching full automation sometime in the future. More information is at the driving.ca site at this link. The webinar is on YouTube and be viewed at this link.

The electric vehicle (EV) ecosystem is closely linked to the CAV ecosystem. Some people refer to Automated, Connected and Electric (ACE) vehicles. In Quebec, the electric and intelligent transport sector (TEI) is booming. According to **Propulsion Québec**'s economic profile of the sector in Quebec in 2019, the sector has about 150

companies, representing sales of $2.2 billion, contributing $1.3 billion of the province's GDP and generating more than 6,000 jobs. The report is here.

Ontario's **Autonomous Vehicle Innovation Network** (AVIN) has published an excellent report on *Smart Mobility for Off-Road Use.* One interesting paragraph says:

> *While it is not fully clear when we will have smart mobility solutions as mainstream on our roads, these technologies have been revolutionizing several industries with their "off-road" use. Autonomous and connected vehicles have already arrived in places other than our roads and have revamped the operations of many industries that are built on mobility using vehicles designed specifically for off-road use. The advantage of a controlled environment has helped these industries march ahead of on-road mobility.*

We agree with the conclusion that non-passenger vehicles may be deployed at scale ahead of passenger CAVs on roads. AVIN's full report is here.

Cities Today magazine has an article on *New Standards on the Way for Delivery Robots*. It addresses the work by **Bern Grush** and **Harmonize Mobility** on the development of a new ISO standard 4448 on curb and sidewalk management. We have reported on this work in previous issues; this new article adds new details and interviews with stakeholders. The article is here.

CASPI News

The CASPI news this month is focused on the student automated snow plow competition.

CASPI received qualifying Technical Paper submissions from three Canadian Universities:

- **Team VAUL** from the Université de Laval
- **Team OC Autoplow** from the University of Ottawa and Carleton University
- **Team Caribou** from the University of Ottawa

The papers will be judged by the first week of April and the winning Technical Paper Team will be announced in the next *CAV Update*.

Due to the COVID-19 pandemic, this year's Phase II (On-Site Demonstration) of the competition has been redesigned to limit the physical contact required between team members, shared equipment, and shared workspaces. A key factor in the design of the competition format is the ability for teams to work entirely remotely (e.g., from a home office/personal garage) and still produce a competitive submission. Personal and public

health are the top priority., It is expected that participants will act in accordance with the most recent public health orders/restrictions in their jurisdictions.

This year Phase II of the competition has been modified by our esteemed panel of judges to accommodate a virtual competition. The objective is not to build an operational snow plow, rather it is for teams to do a “deep dive” into autonomy functions that are essential aspects of autonomous vehicles. The aim is to help teams build capacity for future competitions and to develop skills related to autonomous technologies.

Phase II of the competition will be conducted via a Zoom call on Friday May 14th and the winner announced on Sunday May 16, 2021.

Top Hat Robotics has kindly offered to provide custom Top Hat Robotics toques to the teams. A big thank you to Tim Lichti and his team.

CASPI would like to recognize and thank the people who have made substantial contributions to this competition:

- **Simon Diemert and Kirk Richardson** who developed most of the Concept of Operations (ConOps), as well as the associated messaging.
- **Keith Fagan**, for his excellent work on the graphics, web site, and related work.
- **Nicola Mcleod**, competition’s project manager, for keeping everyone and everything organized and managing the flow of information.

A special thank-you to all four of you.

International CAV News

Qualcomm Technologies, Inc. and **General Motors** (GM) have been long-time partners for several generations of GM vehicles. As part of a new initiative, Qualcomm will be supplying communication and electronic systems to GM for its digital cockpits, telematics systems and advanced driver assistance systems (ADAS). This includes incorporation of Artificial Intelligence (AI) for enhancing in-car virtual assistance, natural interactions between the vehicle and driver and strengthening safety features of GM vehicles. More information is at this link.

San Francisco-based **Starship Technologies** achieved a remarkable milestone in early 2021 by making 1,000,000 deliveries via its delivery robots. Starship is active in the U.S., UK, Germany and Estonia. One of its main areas of focus are deliveries in university and other campuses. Sidewalk delivery robots are a somewhat easier problem to crack than larger vehicles using roads. The reasons are lower speeds (typically 6 Km/h or 3.7 MPH), the robots are smaller, and the environment while quite complex, does not have cars in it. While the mode of operation is mostly autonomous, the robot can call home if it encounters a problem. A remote operator can then direct the robot on what to do next. Starship reports no serious incidents or injuries with its million deliveries since it started its delivery operations in 2018. More information is at this link.

This is another example – mentioned above – of non-passenger CAVs potentially being deployed in volume ahead of passenger CAVs on roads.

One of the long running debates in the CAV space has been the ownership models of future CAVs, i.e., whether they will be privately-owned by individuals or owned by corporations/automakers operating large fleets of CAVs. An academic paper at the UK's *Transport Studies Institute* at **Leeds University** attempts to shed some light on this question. The 13-page paper titled *To own or not to own - That is the question: The value of owning a (fully automated) vehicle*. The paper is based on a survey of 800 people in London and Manchester. One innovative aspect of the paper is defining and putting a value on the *convenience* of owning an automated vehicle. This is over and above regular convenience parameters such as journey time, waiting time and reliability. The ownership convenience factor influences choices among those surveyed significantly, especially among women. The paper can be viewed/downloaded at this link.

Staying with academia, the website of Prof. Kara Kockelman (**University of Texas** at Austin) has compiled 55 papers on CAVs. The publications are listed under the heading of *RESEARCH: Self-Driving, Automated, & Connected Vehicles* on her website and can be viewed at this link.

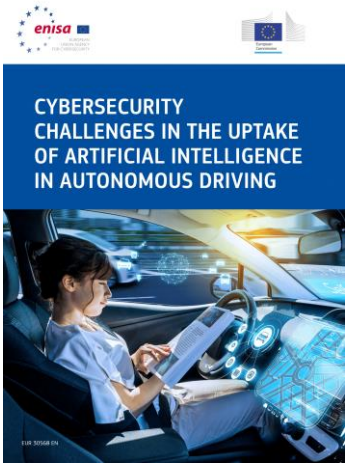
Tesla's approach to development of automated driving has been different than its competitors. For example,Tesla has so far shunned the use of LiDAR in its vehicles whereas other AV companies have adopted it widely as one of their critical sensors.

The same goes for high-defination mapping. Tesla had not used them untill now, instead relying on its AI and computer vision technology. It is now reported that Tesla has hired a large group of *data labellers* to identify artifacts seen/recorded by its cameras - things like vehicles, lanes, street signs, etc. Such data is a lot more valuable when it is “labeled” for use with *deep neural networks*. More information is at this link.

Staying with **Tesla**, the financial website *fool.com* published an article titled *Don't Fall for Elon Musk's Self-Driving Car Fallacy*. The article takes issue with Tesla’s much hyped *Full Self-Driving* (FSD) capability that Tesla has been promising for a long time. In a recent earnings call, Mr. Musk mused that FSD could increase the average use of a Tesla vehicle from 12 hours per week to 60 hours per week and implying that the extra hours can be put to use as a *robotaxi*. He further asserted that this could generate $50 billion additional revenues for Tesla. More details are at this link.

Truck automation and truck platooning have been with us for a number of years. It is estimated that in the U.S. alone, there is a shortage of 60,000 truck drivers. This has led to an interest from the trucking industry in automation and platooning. Pittsburg-based **Locomotion** is developing a concept called *Autonomous Relay Convoys* (also known as *Human-Guided Autonomy*) as an interim step towards fully automated trucks not needing a driver. Like so many other AV companies, Locomotion has its roots at **Carnegie Mellon University** and so far, has attracted US$11.5 million in venture funding. More information is at Locomotion’s own site at this link. A short YouTube video about Locomotion’s technology can be viewed at this link.

Cybersecurity is top of mind for CAVs. In February 2021, The European Community's **Joint Research Center** (JRC) and **The European Union Agency for Cybersecurity** (ENISA) published a 58-page report titled *Cybersecurity Challenges in the Uptake of Artificial Intelligence in Autonomous Vehicles*. The report recognizes the increased digitalization of vehicles and inclusion of Artificial Intelligence (AI) in AVs. Both of these present a *larger attack surface* for hackers and bad actors. For example, intentionally adding paint on the road surface to confuse the navigation system or placing stickers on a stop-sign to prevent its recognition. These alterations can lead to the AI system wrongly classifying objects and cause the AV to behave in a dangerous way. More information at the European Community's site at this link. The report can be viewed/downloaded at this link.



On March 4, 2021, **IEEE Spectrum** published an interview on its website with Dr. Nathaniel Fairfield who leads the *behavior team* at Waymo. This involves the decision-making part of the onboard software, including behavior prediction, planning, routing, fleet response, and control. Nathaniel has been involved with Google/Waymo self-driving car project since its inception in 2009.

Photo-illustration: IEEE Spectrum. Waymo car: Sean Gallup/Getty Images

The main topic of the interview is to get a better understanding of what Waymo means by a *fully autonomous vehicle*. There are some misconceptions on this topic depending on who you ask. SAE defined the five levels of automation a few years ago. Levels 4 and 5 are generally considered fully autonomous vehicles. According to Dr. Fairfield, Waymo robotaxis deployed in the Phoenix area are fully autonomous vehicles. He maintains that these vehicles are not teleoperated from its control centre (called *Fleet Response* by Waymo). However, an automated vehicle can reach out to the control centre if the encounter situations where the vehicle is not sure what to do, e.g., a police officer controlling traffic via hand signals or the vehicle encounters a *road closed* sign. The interview can be viewed on IEEE Spectrum's site at this link.

There is much talk about future robotaxis and how they might impact the public transportation sector. One organization focused on regulations for taxi and limousine services is the **International Association of Transportation Regulators** (ITAR). In concert with many other organizations, CAVs are on the radar of ITAR. At the January 2021 meeting of the **Transportation Research Board** (TRB), ITAR made a presentation titled *IATR's Model Regulations & Best Practices for Shared-Connected & Autonomous Electric Vehicle (S-CAVE) Implementation*. The presentation discusses some of the practical and regulatory aspects of what is needed to bring S-CAVEs to market. The 29-slide presentation can be viewed/downloaded at this link.

On March 15, 2021, **Cruise** - the autonomous vehicle division of **GM** announced the acquisition of another AV company called **Voyage**. This is the latest wave of consolidation in the AV industry with Uber recently leaving the scene, Amazon entering it, and smaller players being absorbed into larger ones. Voyage has specialized in designing AVs suited to seniors living in gated retirement communities in Florida and California. Voyage had a partnership with **Fiat-Chrysler Automobiles** (FCA) which will now come to an end. More information at this link.

The **Reason Foundation** is a non-profit Think Tank based in Los Angeles. In February 2021, it published a 44-page document titled *Challenges and Opportunities for Federal Automated Vehicle Policy*. It lays out several steps policymakers can take to adapt the automotive regulatory apparatus to automated driving system technologies. The document is divided into three main sections: defining automated vehicles, a survey of current federal automated vehicle policy development activities and recommendations for federal policymakers. The recommendations section of this report is the key part of the report. It covers four areas as follows:

- Promote sound regulatory policy development
- Provide temporary regulatory relief for developers
- Ensure uniformity in vehicle safety and performance policy
- Avoid collateral policy damage

More details are at this link. The document can be viewed/downloaded from the foundation's website at this link.

And finally, media is again abuzz with speculation about **Apple** planning to enter the car market and disrupt it. Apple's true and tested business model has been to do the design and specifications and then leave mass production to contract manufacturers. In this vein, Apple has approached Hyundai, Kia, Nissan, and Ferrari so far without any concrete results. Another potential manufacturing partner is Canada's **Magna International Inc.** which has a long history of making automotive parts and doing assembly work for well-known brands such as BMW, Mercedes Benz, and Jaguar Land Rover. More information is at this link.

Upcoming CAV-Related Events

Apr 6-8, 2021	ADAS Sensors 2021; Detroit MI
Apr 25-28, 2021	IEEE Vehicular Technology Conference 2021-Spring, Helsinki, Finland
May 3-6, 2021	Association for Unmanned Vehicle Systems International (AUVSI) 'XPONENTIAL', Atlanta GA
June 8-10, 2021	Autonomous Vehicle Technology Expo 2021, Stuttgart, Germany.
June 16-17, 2021	Autonomous Vehicles 2021, Long Beach CA
June 22-23, 2021	Autonomous Vehicle Technology & Test Expo, Hannover, Germany.
June 20-23, 2021	ITS Canada 2021 Conference
Sept 13-15, 2021	MINExpo, Las Vegas, Nevada
Oct 11-15, 2021	ITS World Congress, Hamburg, Germany
Dec 14-17, 2021	~~UITP Global Public Transport Summit; Melbourne, Australia~~ CANCELLED
Feb 27 – Mar 2, 2022	Ontario Good Roads Association's conference; Fairmont Royal York, Toronto

About CAV Update

CAV Update is a free, monthly summary of news and analysis in the world of connected and automated vehicles, and the 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.*

***CASPI** (the Canadian Automated Snow Plow Initiative) is an association for all stakeholders involved in winter operations and maintenance of sidewalks and trails.*

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