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THE FEBRUARY 2023 ISSUE IN BRIEF

Have you ever thought about how we humans have been trying to do more with fewer of us ever since we entered the animal kingdom? Imagine how many of us humans it took to bring down a mastodon before we invented the mastodon trap, or how many we had to be in a tag team to run down a herd of gazelles before we made our first weapons to deliver a deadly blow from a distance. Then there was the fishing net that made it possible for one man to haul in more fish in a morning than a band of waders could catch with their hands in a week. We came up with the idea of sowing seeds of grain to make bread and porridge to tide us over when the hunting and fishing were poor, but we couldn't sow more than we could reap, turning the old adage of not being able to reap unless we sow on its head. Our biggest invention was the inventor, and all of our inventions have been aimed at one goal: making it possible to do more work with fewer human hands. The side effects have been to be able to do many things at the same time, and to do them faster. Listen to a symphony while driving a car, for example. When it comes to travel, think about why cars with a single driver, single riders on bicycles and e-scooters pass mostly empty buses, why people who are rich enough travel in private jets and buy their own yachts, and why the cabin on a mountain is an ideal. And all the while we are increasing the number of things we can do with fewer people, the population of the world is increasing even more—and faster. There's no mystery to why we are developing robots. It would be odd if we didn't.

THE DISPATCHER

Telematics Industry Insights by Michael L. Sena
February 2023 – Volume 10, Issue 3

Driverless Work Vehicles: On This Side of the Horizon

ITU 2023 Futue Networked Car Symposium

13-16 March 2023

Virtual Event

Session 2: Using Automotive Artificial Intelligence to Improve Vehicle Safety, Services and Transport Management

14 March – 13.00-16.00 CET

For some, the goal of Automotive Artificial Intelligence is to remove the human from the driving task under some or all conditions. For others, it is to supplement and improve the human driver's abilities to make driving safer, offer new and better services, and increase the effectiveness of transport management. This has proven achievable with AI that accomplishes one or a limited set of objectives. This panel will present and discuss views on the current status of vehicle-related applications of artificial intelligence, different scenarios and timelines for their implementation, and concerns for how humans interact with Automotive AI.

Moderator: Michael L. Sena, Editor of THE DISPATCHER

Keynote Speaker: Missy Cummings, Ph.D. – GEORGE MASON UNIVERSITY (USA)

Panelists:

Bryn Balcombe – Autonomy Systems and Regulatory Expert, OXBOTICA (UK)

Junichi Hirose – Highway Industry Development Organization (Japan)

Jenny Lundahl – RISE RESEARCH INSTITUTES OF SWEDEN

Jan Lühmann – Regulatory Affairs Coordinator - VOLKSWAGEN

Land-based robots are already on wheels

WHEN WE THINK of driverless vehicles, our mind's eye tends to drift toward the horizon where we see ourselves at some point in the future being chauffeured around by an artificially intelligent robot in the form of a passenger car. I think it's time to direct our sights toward solutions which are much closer at hand: driverless work vehicles (DWVs). I believe this is where we should be focusing our money and attention. The first image that pops into my head when I think of DWVs is a **Zamboni**,¹ gliding around the Boston Garden ice hockey rink without a driver, smoothing the ice surface in between periods while organ music and the aromas of hot dogs and beer filled the air. I've never seen a driverless Zamboni, but how difficult can it be to build one? I remember reading about super-large KOMATSU driverless dump trucks lumbering in and out of mines with no front or back to them. They're already operating.



I call them 'driverless work vehicles' to distinguish them from 'driverless passenger vehicles' (DPVs). The main difference between these two applications is the business case. We tend to forget that there is a business case on the consumer side for having (buying, leasing, subscribing to, or even sharing) a passenger car. The consumer has weighed the alternatives and determined that having a car is superior to whatever else is on offer. Although a standard passenger car can be used for delivering a taxi service, it would not work well as a combine harvester or an ice resurfacing machine without some major modifications (the first Zamboni was actually built around a surplus army Jeep). There are good reasons for why dump trucks, farm tractors and Zambonis look the way they do and not like

¹ FRANK J. ZAMBONI & COMPANY is a California-based manufacturer of ice resurfacing equipment. Frank J. Zamboni developed the first ice resurfacing machine in 1949, and started the Zamboni Company in 1950. The machines are made in Paramount, California, and in Brantford, Ontario.

Ford Mustangs or Triumph TR2s. Most DWVs were invented to do the work of many men (and women), and taking the last man (or woman) out of the vehicle was probably always the goal.

[Here is what I intend to do in this article:](#)

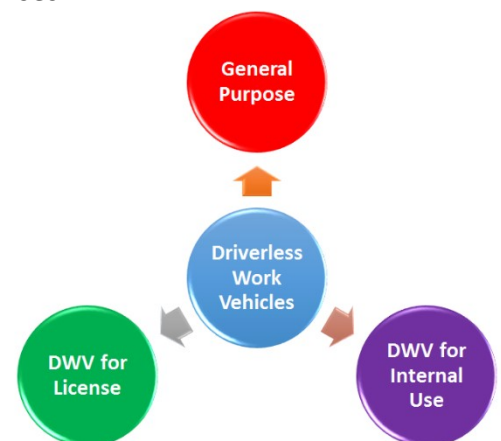
- Provide a classification framework for applications of driverless work vehicles that operate on land;
- Describe some of the companies that have implemented driverless work vehicles and the specific problems they intended to solve by removing drivers;
- Explain how the driverless work vehicle applications interact with humans;
- Describe the issues the applications have had to address to ensure that they are safe;
- Consider how driverless work vehicles affect assignment of liability in case of an accident;
- Finally, I will attempt to identify the factors that differentiate DWVs from driverless passenger cars from a business standpoint, and postulate which offers the greater consumer benefits and potential for profitable operation.

Who is doing what with driverless work vehicles

[Classification framework for DWV companies and applications](#)

Classifying and organizing companies into similar groups helps us to gain a clearer understanding of their main focus and the markets they eventually will serve. My first classification comprises three groups of company types: 1) companies that are developing general purpose hardware and software which they are applying to both driverless passenger vehicles and driverless work vehicles; 2) companies that are developing driverless work vehicle solutions that they will license to third parties; and 3) companies that are developing driverless solutions for their own products or which they can white label for others. We will look at each of these groups, identify their particular traits and identify a sample of companies who are engaged in development of driverless solutions.

A second classification also has three groups. It divides each of the DWV company types up into the operational design domains in which they operate: 1) off-road, including both indoor and outdoor operation areas (a hockey rink could be both indoor and outdoor); 2) unshared roads, with DWVs operating on rights-of-way specifically allocated for use by driverless vehicles; and 3) shared



roads on which both driverless and human-driven vehicles operate concurrently. Off-road vehicles can also include solutions that move on sidewalks or parking lots. Unshared roads can also include roads that are principally for the DWVs, but which can also carry other vehicles that have human drivers who give precedence to the DWVs. Shared roads are those on which all types of traffic can operate, both human-driven and driverless.

General purpose driverless solution developers

Most of the vehicles that competed in the *DARPA Grand Challenge of 2004* were light commercial vehicles, both modified SUVs and pickup trucks.² There were a few contraptions that resembled trucks more than cars, like the one to the right. There was one that looked like an aerodynamic *Zamboni*, shown making its exit from the race in the second photo to the right. None of the competitors in the *2004 Challenge* completed the 142-mile course in the Mojave Desert between Los Angeles and Las Vegas. One team managed to get as far as 7.1 miles. The \$1 million prize went uncollected. A year later, in the next *DARPA Grand Challenge*, five teams finished the 132-mile race, also off-road. All but one of the 23 finalists passed the 7.1 mile mark. In first place was a *VW Touareg* SUV, and places two-to-four were also SUVs: a military HMMWV; a street-legal Hummer; and a Ford Escape. In fifth place was a dump truck entered by *OSHKOSH DEFENSE* called *TerraMax*. This vehicle-neutral approach continued from that point forward, with general purpose driverless hardware and software being fitted on anything with wheels.

Military Applications

It is important to keep in mind the ultimate goal of the *DARPA Challenges*. It was to “accelerate development of the technological foundations for autonomous vehicles that could ultimately substitute for men and women in hazardous military operations, such as supply convoys.”³ Based in large part on the *Challenges*, the *U.S. DEPARTMENT OF DE-*



A Zamboni-look-alike bites the dust in the 2004 DARPA Grand Challenge. Maybe it would have done better if the race had been on the North Pole instead of in the Mojave Desert.



² DARPA is the Defense Advanced Research Projects Agency within the U.S. Department of defense. The 2004 event is considered the start of creating land-based vehicles that drive themselves.

³ The DARPA Grand Challenge: Ten Years Later. <https://www.darpa.mil/news-events/2014-03-13>

DEFENSE has deployed “autonomous ground vehicle technology”. *OSHKOSH DEFENSE* has delivered the *TerraMax* unmanned ground vehicle to the Marine Corps. The six vehicles above are Unmanned Ground Vehicles (UGVs) developed by *OSHKOSH DEFENSE* for the military.

OSHKOSH DEFENSE is a wholly-owned subsidiary of *OSHKOSH CORPORATION*. *OSHKOSH CORP.* It was founded in 1917 as *WISCONSIN DUPLEX AUTO COMPANY* to build a severe-duty four-wheel-drive truck.⁴ Its primary business is military ground vehicles, but it also produces non-military vehicles. A good example is the Next Generation Delivery Vehicle, or postal van in plain speak. *THE U.S. POSTAL SERVICE (USPS)* announced in February 2021 that *OSHKOSH DEFENSE* was awarded an indefinite delivery, indefinite quantity (IDIQ) contract to produce the *Next Generation Delivery Vehicle (NGDV)*, the USPS’s first large-scale fleet procurement in three decades. The competitively awarded contract allows for the delivery of between 50,000 and 165,000 vehicles over a period of 10 years. They will be both battery electric and ICE vehicles.

OSHKOSH DEFENSE unmanned ground vehicle (UGV) technology “advances perception, localization and motion planning to protect Warfighters from IED (Improvised Explosive Device) threats and increase performance in autonomous missions. Integrating high-power military computers, intelligence, drive-by-wire technology and state-of-the-art distributed sensing systems, this technology allows UGVs to run with no driver and limited supervision”. As they say, “When you’d rather not send anyone.” Their driverless systems are not operated remotely like a remotely piloted uncrewed aerial vehicle. However, the routes taken by the vehicles are remotely loaded. Their driverless systems can be integrated into any tactical wheeled vehicle and include LIDAR, radar, cameras, GNSS and accurate positioning without GPS. They are also integrated with ADAS, including electronic stability control, adaptive cruise control, and collision mitigation braking.

OSHKOSH isn’t alone in developing unmanned ground vehicles. *GENERAL DYNAMICS LAND SYSTEMS*, founded in 1982, is the largest. It is a subsidiary of General Dynamics, a global aerospace and defense corporation, producing airplanes and air control systems for the private sector and air, ground and sea defense systems. *AM GENERAL* produces the high-mobility multipurpose wheeled



The Oshkosh Defense® Joint Light Tactical Vehicle (JLTV)



Oshkosh Defense NGDV is not going to win any design prizes, but it's got lots of creature-comforts.

⁴ <https://oshkoshdefense.com/about/>

vehicle (HMMWV, better known as the Humvee). It is heavily involved autonomous control systems for all types of vehicles.

Another competitor to OSHKOSH DEFENSE is AM GENERAL, which was founded in 1971 when AMERICAN MOTORS spun off its JEEP CORPORATION and GENERAL PRODUCTS DIVISION.⁵ It has deep military vehicle roots in STUDEBAKER and WILLYS-JEEP.

These companies, and similar ones around the globe, have decades of experience developing and manufacturing vehicles that do many different kinds of jobs, from simply chauffeuring an officer and a radio technician in a Jeep to supplying ammunition to the front lines. It is their customers (national governments) who have the deep pockets needed fund research in driverless technologies, and they have shown they are prepared to do so.

Commercial Applications

AURORA INNOVATION, INC. is one of the best-known general purpose driverless solution providers. It was founded in 2016 by two members of the 2007 Urban Challenge winning Tartan Racing Team from CARNEGIE MELLON UNIVERSITY in Pittsburgh, PA, Chris Urmson and Drew Bagnell, and Sterling Anderson who had come from TESLA. As I wrote in the [January 2023 issue of THE DISPATCHER](#), AURORA claims it is making a shift from cars to trucks as the principal market for its *Aurora Driver* product. This is what it says about its transition from mostly cars to mostly trucks: *“Because we’re building the Aurora Driver to operate both trucks and passenger vehicles, advances made in either vehicle type directly benefit the other. For example, the same high-speed driving capabilities that allow our trucks to operate on highways will also benefit ride-hailing customers traveling on popular, high-speed trips to and from the airport...We’re seeing our customers solve real problems. When we look in this freight space, we see a very clear direction.”*

⁵ American Motors was formed in 1954 as a result of the merger of Nash-Kelvinator Corp. and Hudson Motor Car Company. It was acquired by Chrysler Corporation in 1987 for \$1.5 billion.



Aurora says its plan is to address “an enormous transportation market—Trucking is our first focus”.⁶ In addition to providing technology, it is also planning to offer Aurora Horizon, an autonomous trucking subscription service. Its model is to deliver a Driver-as-a-Service, with the driver being the Aurora robot.



Here are the clients/partners it lists on its web site: TOYOTA, FEDEX, VOLVO TRUCKS, PACCAR, UBER, UBER FREIGHT, U.S. XPRESS, WERNER, COVENANT, and SCHNEIDER. It does not mention AMAZON, which took a 5% stake in 2021. It doesn't mention HYUNDAI either, which invested \$600 million in 2019 at the same time as it stated that it would deliver driverless cars in 2021. Aurora went public in a SPAC in November 2021. It started out with a market capitalization of close to \$15 billion. On the 5th of January 2023, its market cap was \$1.46 billion. This is what I wrote about AURORA in the September 2019 issue of *THE DISPATCHER*, before its IPO and before it decided that trucking was its “first focus”. It appears the principals have decided to shift that focus in order to stay in business.

Will it be AURORA's fate to be gobbled up, either literally like CRUISE AUTOMATION by GM, or figuratively like ARGO AI by VW and FORD? Is that their end-game, or does the company want to eventually shift up from first gear where it is now and become a company providing its technology to multiple vehicle OEMs? Experience has shown that OEMs do not support the independent technology model when it comes to core features, which driverless technology definitely is. If the principals could not manage as employees at Uber, Google or Tesla, it is doubtful that they will be interested in wearing FCA or Hyundai company badges for very long. Somehow, I don't see them being in auto industry in a few years' time.

⁶https://d1io3yog0oux5.cloudfront.net/_817625bb7e21077669d53e6476e3a084/aurora/db/856/7862/pdf/Aurora+Investor+Presentation+-+December+2022.pdf

Waymo is best known for the software and hardware systems it has installed in passenger cars, particularly the *Chrysler Pacifica*, in which it has been testing a form of taxi service in Chandler, AZ and more recently in San Francisco. The company is actually divided into three main divisions. *Waymo Driver* is responsible for developing the software and hardware technology for all of its driverless applications, *Waymo One* is the taxi service, and **Waymo Via** is the group developing solutions for the trucking industry, both heavy, long haul trucking and local delivery vehicles. It has been performing tests with UPS and J.B. Hunt, an American company that operates large semi-trailer trucks and provides transportation services throughout North America. It has 24,000 employees and operates around 12,000 trucks.



Here is what J.B. Hunt's Chief Sustainability Officer says about its trial with Waymo: *"This will be one of the first opportunities for J.B. Hunt to receive data and feedback on customer freight moved with a Class 8 tractor operating at this level of autonomy. While we believe there will be a need for highly skilled, professional drivers for many years to come, it is important for J.B. Hunt as an industry leader to be involved early in the development of advanced autonomous technologies and driving systems to ensure that their implementation will improve efficiency while enhancing safety."*⁷ This is hardly a whole-hearted endorsement of driverless trucks. Like AMAZON testing drone and sidewalk robot deliveries and deciding they were not up to the task, it sounds like J.B. HUNT wants to see whether there is any point to using robot-driven trucks.

DWV solutions for license to third parties

The second group of companies develops driverless solutions just for work vehicles, not for passenger cars, and they license their solutions to third parties. They are not in the vehicle-building business but in the driverless solution business. It may seem like I am splitting hairs, but I believe that a company trying simultaneously to serve multiple markets in the hope that one of them will pan out is going to need more resources, both money and people, to do a good job on each of the them, or it is going to give all areas short shrift. Military applications are one market, even though the size and shape of the vehicle changes, but taxi services and a long-haul trucking are operations are very different markets and business cases. Waymo has access to plenty of money from its parent, Google (at least it did before Google's valuation was halved during

⁷ <https://blog.waymo.com/2021/06/waymo-via-is-working-with-jb-hunt-to.html>

the past year), so it might be able to straddle passenger cars and long- or short-haul trucking, but they are an exception.

Locomotion, TuSimple and Embark

Companies working in this sector all have different approaches. LOCOMOTIONAI was founded in 2018 by a group from CARNEGIE MELLON'S NATIONAL ROBOTICS ENGINEERING CENTER.⁸ Like AURORA, it is based in Pittsburgh, PA. Its proposed key to success is to pair trucks in a two-truck convoy. It is developing retrofit kits and looking for partners.

EMBARK TRUCKS, INC. was founded in 2016 in San Francisco by three Canadian friends who dropped out of the college they were attending, the University of Waterloo, with an idea of developing a driverless trucking solutions that can be installed on all trucks. Five years later, in November 2021, Embark and Northern Genesis Acquisition II completed SPAC and Embark started trading at \$176 per share. On the 6th of January 2023 its share price was \$3.08. What is EMBARK'S secret sauce? *Vision Map Fusion*.⁹ "VMF uses Embark patent-pending, nonlinear-optimization techniques to update the map in real-time using detailed road geometry data from LiDAR and camera sensors."

TUSIMPLE HOLDINGS, INC. is a company, based in San Diego, California founded in 2015 by Xiaodi Hou and Mo Chen. The company went public in April 2021, raising \$1 billion and generating a value of nearly \$8.5 billion. Its shares traded as high as \$63.13 in July 2015. On the 6th of January 2023, the share price stood at \$1.58. What happened? In October 2022, Xiaodi Hou was removed as CEO after an investigation by the company's board found that some employees spent paid hours working for HYDRON INC., a Chinese startup also working on driverless trucks—which is owned by the other founder, Mo Chen. Following this, it laid off 25% of its staff, nearly 350 employees, and took a one-time charge of nearly \$11 million which will be recorded in the fourth quarter of 2023. Its investor presentation has slides labeled *Active Improvement to Corporate Governance*, *Stabilized Management Team*, and *Strategy to Return to Our Roots*. VW'S TRATON GROUP, which includes SCANIA and MAN in Europe and NAVISTAR in the U.S., took a minor stake in TUSIMPLE and had a deal to develop heavy-duty

⁸ CMU NREC was the same organization with which Uber had a strategic partnership before it hired away forty of the Cente's faculty and thirty-six of its research staff for Uber's Advanced Technologies Center. The Center was sold to Aurora along with its entire self-driving car unit in 2020.

⁹ <https://embarktrucks.com/technology/>

self-driving trucks by 2024. As a result of the instability of the company, NAVISTAR scrapped their deal.

Each of these companies is attempting to make a breakthrough that will distinguish them from their general purpose competitors and create a compelling reason for one or more truck manufacturers to use their solutions, rather than those truck manufacturers building their own solutions internally or simply acquiring one of the suppliers, as happened with CRUISE and ARGOAI. It appears that it's not going so well for these three companies in group right now.

Oxbotica

Things appear to be going very well for OXBOTICA, a company headquartered in Oxford, UK. It was founded in 2014 by Paul Newman (no, not the founder of Newman's own spaghetti sauce) and Ingmar Posner. The pair led the *RobotCar UK* project in 2013 as part of OXFORD UNIVERSITY'S *Department of Engineering Science Mobile Robotics Group*. OXBOTICA is an autonomous vehicle software company. Its *Universal Autonomy* software is both vehicle- and platform agnostic. The company claims its platform can be deployed in any environment and on any terrain, including underground, because it has no reliance on GNSS signals.

On the 11th of January 2023, the company announced that it had raised \$140 million in a Series C¹⁰ investment to deploy its *Universal Autonomy* operating system around the world in domains where there is both an urgent need and potential to scale, such as agriculture, airports, energy, goods delivery, mining, and shared passenger transportation. Investors in this round include organizations in North America, APAC and EMEA.

Internal DWV development

These are the companies producing vehicles and developing the driverless solutions for them. They range from minibuses from NAVYA to farm tractors from JOHN DEERE and truck tractors from VOLVO, EINRIDE, and DAIMLER. They are the core of the driverless work vehicle business because they are the core of the work vehicle business. They know what their customers need to get their work done. Alongside the combine harvester, the tractor is one of



The Väderstad Tempo L 16-24 Central Fill pulled behind a tractor both seeds and fertilizes in a central bulk system.

¹⁰ Series C financing (also known as series C round or series C funding) is one of the stages in the capital-raising process by a startup. The series C round is the fourth stage of startup financing, and typically the last stage of venture capital financing. However, some companies opt to conduct more rounds, such as series D, E, etc.

the most important work vehicles that has been invented. I imagine that after the plow was conceived by an overachiever, and another bright mind put an ox, mule and then a horse in front of it, at least one ancient farmer wondered why those oxen, mules or horses needed to have him holding on to the plow. “Why in thunder’s name can’t they pull the plow themselves?” he probably said.

History and Development of the Plow

The antecedent of the plow is the prehistoric digging stick. The earliest plows were doubtless digging sticks fashioned with handles for pulling or pushing. By Roman times, light, wheelless plows with iron shares (blades) were drawn by oxen; these implements could break up the topsoil of the Mediterranean regions but could not handle the heavier soils of northwestern Europe. The wheeled plow, at first drawn by oxen but later by horses, made possible the northward spread of European agriculture. The 18th-century addition of the moldboard, which turned the furrow slice cut by the plowshare, was an important advance. In the mid-19th century the black prairie soils of the American Midwest challenged the strength of the existing plow, and American mechanic John Deere invented the all-steel one-piece share and moldboard. The three-wheel sulky plow followed and, with the introduction of the kerosene and then gasoline engine, the tractor-drawn plow.¹¹

John Deere

DEERE & COMPANY, doing business as JOHN DEERE, is an American corporation that manufactures agricultural machinery, heavy equipment, forestry machinery, diesel engines, drivetrains (axles, transmissions, gearboxes) used in heavy equipment, and lawn care equipment. The company also provides financial services and other related activities. It replaced oxen, mules, and horses with a two-cylinder kerosene-burning engine in 1923.

JOHN DEERE was the darling of CES 2023. It was named *CES 2023 Innovation Awards Best of Innovation* honoree in the Robotics category, and an honoree in the *Vehicle Tech & Advanced Mobility* category for its fully autonomous tractor.¹² This is the fourth consecutive year JOHN DEERE has received an Innovation Award from the CONSUMER TECHNOLOGY ASSOCIATION (CTA). The business need for a driverless tractor was summed up by Jahmy Hindman, chief technology officer for John Deere: “Farmers never have a



The John Deere Model D tractor was introduced in 1923 and became the first tractor built, marketed, and named John Deere.



Here is the John Deere driverless tractor.

¹¹ <https://www.britannica.com/technology/plow>

¹² <https://www.deere.com/en/news/all-news/john-deere-wins-two-ces-2023-innovation-awards/>

shortage of work to do on any given day. With our fully autonomous tractor, farmers have the flexibility to focus on the most pressing tasks within their operation while the machine handles what they don't have time or labor to do."

According to DEERE, the tractor has six pairs of stereo cameras, which enables 360-degree obstacle detection and the calculation of distance. Images captured by the cameras are passed through a deep neural network that classifies each pixel in approximately 100 milliseconds and determines if the machine continues to move or stops, depending on if an obstacle is detected. The driverless tractor is also continuously checking its position relative to a geofence, ensuring it is operating where it is supposed to, and is within less than an inch of accuracy. Farmers only need to transport the machine to a field and configure it for autonomous operation. The farmer starts the machine using a *John Deere Operations Center Mobile App*. While the machine is working the farmer can leave the field to focus on other tasks, while monitoring the machine's status from their mobile device. Customer deliveries will begin in 2023. Who wouldn't want one of these?

Einride

EINRIDE unabashedly presents itself to the world as "the leading provider of digital, electric and autonomous shipping technology". There is one catch to EINRIDE's autonomous claim: there is always a human sitting off somewhere who is always in the ride loop. The company was founded in Sweden in 2016 by Robert Falck and his wife Linnéa Kornehed Falck, and Filip Lilja. Their intention was to build an electric truck that did not have a driver sitting in a cab in front of a trailer. Technically, it is not a driverless truck; it just puts the driver somewhere else.

It's not clear to me whether EINRIDE is in the electric truck optimization business or in the remote truck operating business. It is buying 200 electric trucks built by BYD for operation in the U.S., but those trucks will all have drivers. EINRIDE will supply its SAGA electric technology platform. In June 2023 Einride received a waiver from NHTSA to operate its remotely driven vehicles on public roads in mixed traffic. The public road pilot took place in Selmer, Tennessee during a two-week period in the October at a GE APPLIANCES facility. It was a quiet public road (see photo right).

Volvo Trucks

VOLVO TRUCKS is part of VOLVO GROUP, which includes these ten business areas: VOLVO TRUCKS, RENAULT TRUCKS, MACK TRUCKS, VOLVO CONSTRUCTION EQUIPMENT, VOLVO BUSES, VOLVO PENTA, ARQUUS, VOLVO



This is the public road Einride used for testing in Selmer, TN. It's a start.

FINANCIAL SERVICES, VOLVO AUTONOMOUS SOLUTIONS and VOLVO ENERGY. It does NOT include VOLVO CARS, which is owned primarily by GEELY. In 2019, VOLVO GROUP announced that it would be forming a new business unit called **VOLVO AUTONOMOUS SOLUTIONS**, which began operations on 1 January 2020. At the time, VOLVO said that the new business would “help it meet the growing demand and offer services in such segments as mining, ports, and transport between logistics centers”.¹³ VOLVO had already begun working on an electric, connected and autonomous vehicle, called Vera, which was part of the reason for establishing VAS. The image to the right is VOLVO’s VERA (you should be able to see the VOLVO logo on the hood). It looks like one of those airport trucks that slip under the noses of planes.



Volvo VERA

In April, VOLVO put the brakes on Vera. Nils Jaeger, Managing Director for VAS explained in an interview with *DAGENS INDUSTRI* that driverless trucks on public roads would exist sometime in the future—but not now. “VERA is a great vehicle, but it’s too early for a truck without a place for a safety driver. We will continue with development of VERA in the belief that it will be useable in the future,” said Jaeger. VOLVO’s main focus at the moment is on driverless dump trucks that are for restricted work places, like mines and quarries.¹⁴ This is what TARA aims to address.



Volvo TARA

Komatsu

The KOMATSU LTD. *Innovative Autonomous Haulage Vehicle*, aka ‘dump truck’, was introduced in 2016. It’s a 2,700 horsepower driverless truck that has no back or front, and no driver. It has put over 500 driverless vehicles on the ground since its introduction.



Komatsu IAHV

Navya

Another company with a focus on driverless work vehicles is NAVYA, S.A.S., based in Paris and Lyon, France. It is the successor to a company called INDUCT which created a prototype self-driving electric van called *Navia*. In 2014, INDUCT went into receivership and its assets were taken over by an investment fund, ROBOLUTION CAPITAL. Six engineers from NAVIA stayed with the new company, and a year after *Navya*’s founding, it launched its first production vehicle, the *Navya Arma*. It is a 15-person driverless shuttle bus with a top speed of 45 mph. It made its global debut in 2017 in Las Vegas in a partnership with the City of Las Vegas, KEOLIS, a



Navya Arma

¹³ <https://www.volvogroup.com/en/news-and-media/news/2019/oct/news-3448625.html>

¹⁴ <https://im-mining.com/2020/07/07/volvo-autonomous-solutions-next-steps-tara-battery-electric-autonomous-haulage-offering/>

French transport operator, and AAA OF NORTHERN CALIFORNIA, NEVADA AND UTAH. Safety operators were on board. In 2020, KEOLIS and NAVYA put into service a shuttle without an onboard safety operator in Chateauroux, France.

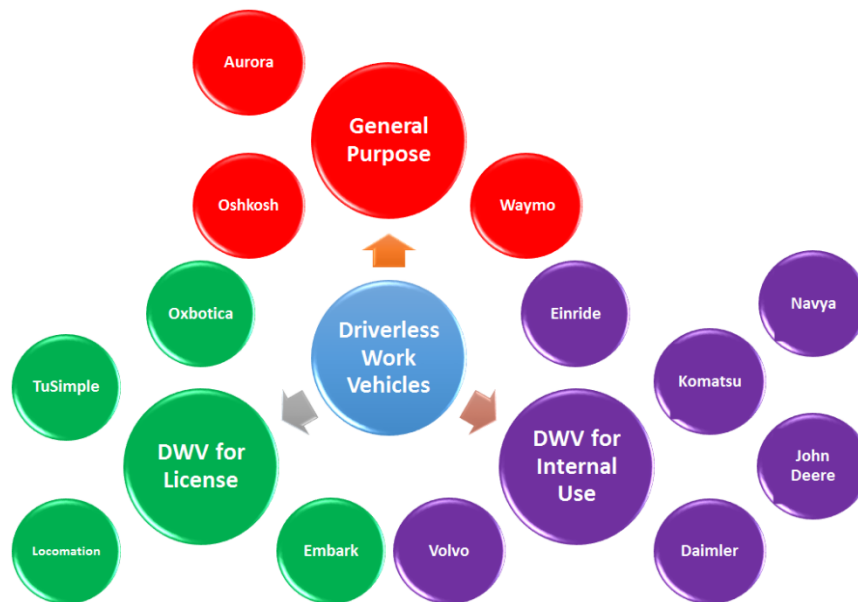
Daimler with TORC Robotics

TORC ROBOTICS, which was one of the six finishers in the 2007 DARPA Urban Challenge,¹⁵ developed utility-vehicle-scale autonomous vehicle platform, also for the Marine Corps. In 2019, TORC became an independent subsidiary of DAIMLER AG, which acquired a majority stake in the company through its subsidiary, DAIMLER TRUCKS NORTH AMERICA. In 2021, TORC established partnerships with AMAZON WEB SERVICES as its preferred cloud provider, LUMINAR Technologies for LiDAR, and APPLIED INTUITION for simulation technology. TORC has established the *TORC Autonomous Advisory Council (TAAC)* with freight industry players to incorporate their industry insights into its development process. Council members include SCHNEIDER, COVENANT LOGISTICS, PENSKE TRUCK LEASING, RYDER SYSTEM, INC., C.H. ROBINSON AND BATON as well as DAIMLER TRUCK NORTH AMERICA. They will provide strategic guidance to TORC as it integrates with the freight network and addresses challenges beyond highway driving.



TORC Robotics

A sample of Driverless Work Vehicles by development focus



¹⁵ The 2007 DARPA Urban Challenge, held in November 2007 at the former George Air Force Base in Victoria, California, was the third and last of the driverless car challenges. Six teams completed the course, four SUVs and two passenger cars.

DWV safety and liability issues

Are there any special issues concerning safety or liability that driverless work vehicles have which driverless passenger vehicles do not have? There is a precedent for the driverless tractor on a much smaller scale that we can use for comparison purposes. It is the robotic lawn mower. Safety warnings on the devices caution that pets and children should be kept away from them. They are a particular danger to small, slow-moving animals, like hedgehogs and ducklings. Today's vision-based and GNSS-equipped lawn mower robots are much safer than those that came onto the home care market fifteen-or-so years ago. They can operate without perimeter wires and don't have to bump into or roll over an object, such as a little critter or a foot, to know it should shut down, but they have to be trained by their developers to tell the difference between objects that will do damage to mower, objects which the mower will damage, and objects that need to be mowed, like big tufts of grass. Similar problems will exist with driverless vehicles that function within restricted ODDs.



Are there special liability issues with DWVs?

I found an excellent article on the subject of safety and liability for driverless work vehicles written in 2002 (yes, 21 years ago!) by Jan Lowenberg-DeBoer, an expert in both agriculture and farm machinery automation. He was the director of the PURDUE UNIVERSITY COLLEGE OF AGRICULTURE precision farming center.¹⁶ His insights are prescient considering that they were written well before robotic vehicle development had gotten off the drawing board. Here is what he wrote: *“One of the key disadvantages of driverless machines for agriculture is liability. Unlike factory robots, agricultural machines must work in public. One news report of a malfunctioning machine that crashes into a neighbor’s yard or of a machine that fails to recognize a dog or child and runs it over would create a firestorm of negative publicity. This type of accident is not new. Unfortunately, every year pets and children are hurt by tractors and other equipment. What is different for autonomous equipment is the perception that the accident was in part due to the lack of a human to intervene.”*¹⁷

¹⁶ Precision farming is the use of information technologies and other technologies like GPS to allow farmers to develop and effectively implement soil and crop management plans that fit the specific conditions of a particular field.

¹⁷ <https://ag.purdue.edu/ssmc/newsletters/autonomous%20tractor%20SSMC%20newsletter%20280202b.htm>

Professor Lowenberg-DeBoer suggests that insurance companies are likely to require that a human safety driver be present in order to turn off the equipment if necessary. This, he says, would negate the principal benefits of automating the equipment. Additional precautions that might be required, he suggests, are fences around the fields in which the machinery is operating to prevent humans and animals from wandering in. Safety measures may add to the cost to such a degree that the economic benefits are nullified. These and other measures will probably be reduced as people become accustomed to co-existing with driverless technology and with the addition of more sensitive and effective sensor technology, writes Professor Lowenberg DeBoer, but “periodic human presence in the field (i.e., where the machine is operating) is likely to be necessary for the near future,” he says.

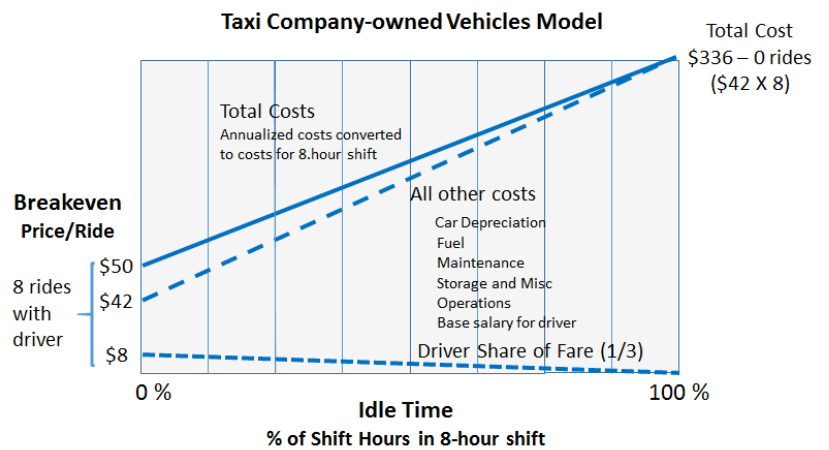
One of his suggestions is to change the paradigm which has evolved over time as a result of doing more with fewer hands, which has been to make equipment larger. *“Autonomous farm equipment may be in our future, but there are important reasons for thinking that it may not just be replacing the human driver with a computer. It may mean a rethinking of how crop production is done. In particular, once the driver is not needed, bigger is no longer better. Crop production may be done better and cheaper with a swarm (again, 21 years ago) of small machines than with a few large ones. One of the advantages of the smaller machines is that they may be more acceptable to the non-farm community.”* This is the kind of thinking that is conspicuous by its absence from discussions about making vehicles driverless. It is not just taking the driver out and replacing him or her with a computer. Rethinking the purpose of the vehicle and the task it is performing, especially with considerations of safety and liability in mind, may well lead to completely new vehicle designs and totally different processes.

Business factors differentiating DWVs from DPVs

An ice resurfacers, a farm tractor, a combine harvester, or a *mine resistant ambush protected* military vehicle are different from a taxi or an on-demand shuttle, and they are both different from commercial trucks of all classes. With driverless work vehicles, the cost of the driver is normally included into the total operating costs, and the drivers must be paid for the time they are operating the vehicle, whether the vehicle is idling waiting for a load or a passenger or actually carrying the load or passenger. The main exception is driver-owned chauffeuring businesses, including peer-to-peer services using platforms such as those provided by UBER and LYFT.

It would be useful to compare the cost model for company-owned versus driver-owned taxis as a benchmark for analyzing driverless work vehicles. When the vehicle used for providing rides is owned by the taxi company, the driver receives a base salary and a share of the fare, usually one-third. The taxi companies must cover all vehicle-related costs as well as their own operations costs and a base salary for the taxi driver. If the car spends an entire shift without a fare, the taxi company still has all the vehicle-related and operations costs, as well as the base salary of the driver to cover. Drivers receive their base salaries, but miss out on the one-third of the fare.¹⁸ This model worked for both the taxi companies and drivers as long as they could limit supply in order to keep idle times to an absolute minimum. Deregulation changed the equation, and the Internet provided a tool to allow drivers and riders to find each other without riders having to stand in the rain and snow to hail down a taxi, or wait for hours on New Year's Eve.

What UBER and other similar companies did was to take a similar portion of the fare as the taxi companies (initially 20%, but now closer to 40%) while pushing all the costs of the vehicle on to the driver. It justified this by providing the peer-to-peer platform that put drivers together with riders. Who benefits if the driver is removed from the equation? UBER would have to find someone



¹⁸ <https://work.chron.com/much-fare-taxi-drivers-keep-22871.html>

else to assume all of the vehicle costs, but whoever does this will not do it for free. The 60-70% of the fare that it would keep would be eaten up by the fee it would have to pay the vehicle provider. Certainly, the driver/car owner does not benefit unless it is the driver/car owner who is providing the driverless car to UBER. This lack of a business case explains why UBER got out of the driverless car business, and no one else has shown that it can work.

In the case of ice resurfacing vehicles and farm machinery, the vehicles are not necessarily being driven by persons hired just to drive the particular vehicle. These vehicles were developed to perform a special function at a particular time, and when they are not being used, they are parked somewhere in a protected location. They are time- and labor-saving devices. They do the work that took many laborers many hours to complete. Frank Zamboni invented his machine because he owned an ice skating rink and he found that cleaning the ice was emptying his pockets of lots of cash. It was a labor-intensive and time-consuming task. Several workers walked behind a scraper being pulled by a tractor. The workers scooped up the shavings, sprayed the ice with water, and squeegeed the surface to make it smooth. According to the Zamboni website, the process took more than an hour, significantly reducing ice time for the customers. His invention, operated by a single driver did the whole job in ten minutes.

Combine harvesters, shown right, offer a simple and straightforward example of the business case for a work vehicle. They are called 'combines' because they do four separate harvesting operations: reaping, threshing, gathering and winnowing. They harvest many different types of crops, from wheat to rice, oats to flax. When they have driven through a field of ripe grain, what is left is straw that is either chopped up and ploughed back into the field or baled for bedding and feed for livestock. So when the combines entered the harvesting job, first pulled by large teams of mules, then tractors, and finally moving under their own steam, they not only put the reapers out of work; they put all of the others who separated those tiny grains from the chaff.¹⁹ The bigger they got, the more they could harvest in increasingly less time.

The difference between the total depreciation cost of the combine along with fuel, storage, maintenance and driver versus the cost of an estimated 50 labors working during a two-month harvesting period is what goes into the farm owner's piggy bank to



¹⁹ https://en.wikipedia.org/wiki/Combine_harvester

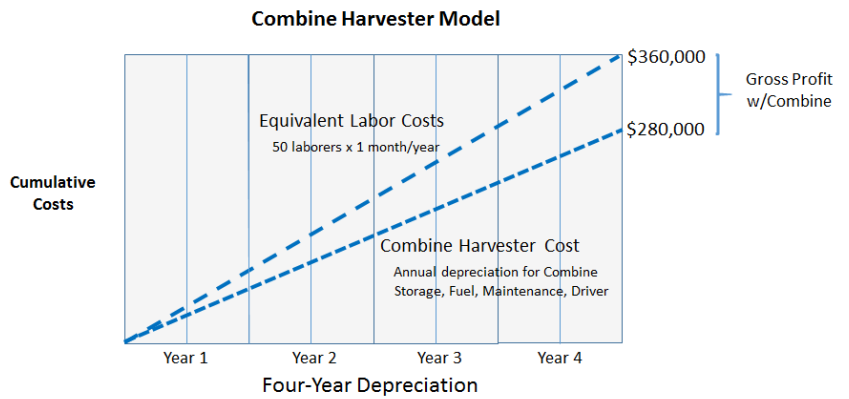
tide the family over during the seasons when the harvest is small or non-existent. A big farm might be able to afford its own combine, but an enterprising individual could put himself into the combine harvesting business and rent himself out to a group of farmers in the region. The salary for a combine harvester driver operating the vehicle would be about the same as an experienced farmhand, or around \$37,000 per year. That's around \$6,000 for the two-month harvesting period, but if a farmer is trying to manage a big farm with a rock bottom minimum of employees because finding farmhands is extremely difficult, it's not the money saved on the driver that is important.

When you'd rather not send anyone

There is a very compelling business model for a driverless military vehicle which *OSHKOSH DEFENSE* sums up perfectly in its lead-in to describing the vehicle solutions it has developed for the military: "When you'd rather not send anyone." If the U.S. loses one F-16 fighter jet, \$19 million goes up in smoke. But if the pilot of that jet is killed as well, depending on how long he or she has been in service, an amount of money close to the price of the jet will also be lost. Recruiting one U.S. Marine costs \$6,539.²⁰ Before that Marine is ready to deploy, the government will spend around \$45,000 to prepare him or her. The jet pilot is likely to have spent at least four years in college. A West Point degree in engineering will set the government back \$340,000. There is no way to put a price on a life lost, but it is possible to attach a price to a life saved.

Is there a business case for driverless long-haul or short-haul trucking?

The main justification used for developing trucks without drivers is that there is a major shortage of qualified drivers for long-haul trucking, and the gap between demand and supply is increasing. Long-haul trucking is typically considered anything over 250 miles (400 kilometers), but many long-haul truckers drive much longer routes. Drivers generally has some control over the route lengths they drive. The AMERICAN TRUCKING ASSOCIATION claimed that in



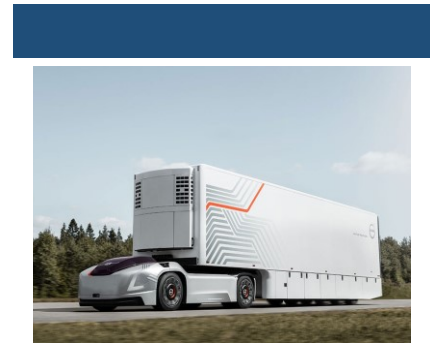
²⁰ <https://www.nbcnews.com/id/wbna3072945>

2021 there was a shortage of 80,000 drivers, and that this number could double by 2030.²¹ It's worse in Europe where the shortfall is 400,000.²² Why is there such a large shortage and is replacing the driver with a robot going to solve the problem? The answer to the first question is fairly simple: It's a hard job that doesn't pay enough for the sacrifices it demands.

The hard part is not lifting heavy loads, it is being on the road for long periods of time, returning home only a few times a month. Drivers live and eat mostly in their vehicles, and shower in rest stops. There are hours of service rules that limit the amount of time a driver can stay behind the wheel and how much time he/she (mostly he) must rest, but driving for eight hours at a stretch for seven days in a row is not for everyone. Women make up only around 7% of the drivers, both in the U.S. and EU, so the pool of prospective drivers is halved, and the minimum of age of 21 means that the group with the largest level of unemployment cannot be tapped.

An experienced long-haul truck driver earns \$86,000 per year, while the average driver salary is \$53,000. The annual salary for a 25-34 year-old with a master's degree or higher is \$69,700.²³ There are other jobs that a person can do that pay a similar salary as a truck driver and which do not require a college degree, like steelworker, electrician, power plant operators, and elevator installers and repairers, but the barriers to becoming a truck driver are probably lower than most professions. So, it's not the money or the driving; it's living in a truck and babysitting the truck that is carrying, delivering and picking up loads in places that are far from home. With the average age of long-haul truck drivers over 50, it does not appear that the life of a trucker is appealing enough for the younger generation of men—or women.

I am spending time on analyzing this problem because it is critical to the determining whether removing the driver solves the driver shortage problem or just creates more problems that need to be solved, like who will maintain the truck, who will guard the truck



In 2018, Volvo Trucks presented its concept for an autonomous commercial electric vehicle. It stated at the time that the long-term goal was to offer companies transport services between fixed hubs.



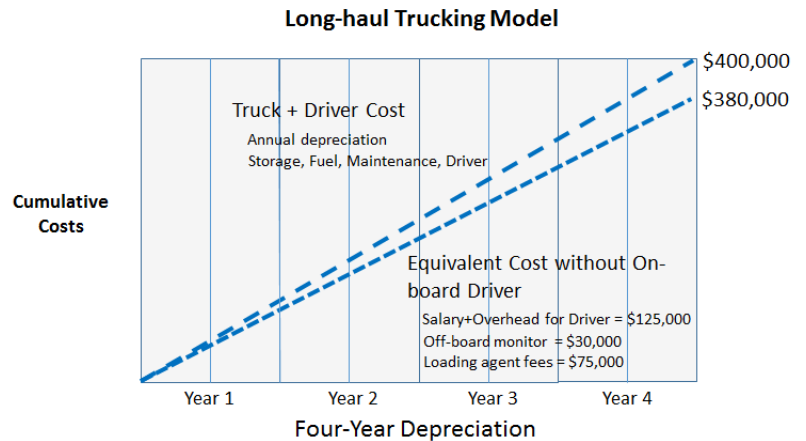
A home away from home

²¹ https://www.redwoodlogistics.com/ata-says-the-nation-needs-another-80000-truck-drivers/#What_Can_Be_Done_to_Address_the_Shortage_of_Truck_Drivers

²² <https://www.ti-insight.com/briefs/europes-road-freight-market-short-of-more-400000-drivers/> and International Transport Union (<https://www.iru.org/news-resources/newsroom/europe-driver-shortage-triple-2026-if-no-action-new-iru-report>)

²³ <https://www.forbes.com/advisor/student-loans/average-salary-college-graduates/>

when it is parked, who will find a place to stop if the loading slot time is missed, who will talk with the customs officers if there is a problem with the load, among many more issues? Keep in mind that the long-haul trucking model replaced shipping by train because it provided the flexible means of moving goods from shipping ports to multiple regional distributing centers set up by the likes of WALMART and AMAZON. What happens if that model changes? Does the need for driverless trucks disappear? It's worth considering.



From a strictly business case point of view, removing the driver is not going to be cheaper overall. There will need to be someone monitoring the vehicle remotely using expensive equipment. There will need to be people ready to do the work the driver did when the load is being picked up or delivered. There will need to be a crew ready to get to the vehicle if there is any type of technical problem. Savings from removing the driver will quickly be eaten up by these extra costs and increase the cost of the vehicles as well as its maintenance. More than likely, there will need to be a person in the cab even if he or she is not driving.



Where we are with Driverless Work Vehicles

What did it take for the largest consumer electronics show organizers to return to earth? Well, not totally. Not all the way down on the ground with two feet. CES is still sort of hovering above the surface, like those drones from China's DJI and AUTEL that dominate the market. CES is where they got their start. At this year's pre-Show, Steve Koenig, CONSUMER TECHNOLOGY ASSOCIATION Chief Economist, made the following statement: "We've been talking for years and years about self-driving vehicles happening, but now we're starting to see autonomy really earnestly move beyond passenger vehicles." I wonder how much it really earnestly hurt to say these words, Steve.

Let's be clear: It has been CES pushing the hype, talking and talking for years, and venture capitalists pushing CES. It's been around ten years since CES began to push the "Driverless cars are just around the corner" message. By "moving beyond passenger vehicles", he doesn't mean that passenger vehicles are ready to roll; he means that "they" (tech guys, car companies) couldn't get driverless passenger vehicles to work from a commercial standpoint, so we (CES) are moving on to something that we think just might work, and now we're going to keep talking about them. "Self-driving heavy trucks are leading autonomous technology development," he said. "Autonomous vehicle tech companies at CES are looking to show investors how they will offer value in 2023."

I don't think "autonomous vehicle tech companies" are going to show investors anything at CES or anywhere else. Companies that make work vehicles for a living, and who might buy technology from various suppliers like AURORA or Waymo, will be showing customers in the coming months/years how they can save money and operate more effectively to get their work done by employing driverless systems. And it is not just heavy trucks, or maybe it's not even heavy trucks. The makers of work vehicles will start with the most simple fact that people have to eat, and since we humans have decided that everyone is not going to grow or capture their own food, and that we will busy ourselves with "digitalization" and "screenification" and "urbanification", it will fall to those few folks who produce and deliver the food we need to keep ourselves going. They are the ones who will need technological answers. I'm not sure they attend CES, or whether it would be a better bet to meet up with them at the farm and livestock festivals. Maybe the NATIONAL FARM MACHINERY SHOW held in Boone, Iowa will become the new venue for driverless technology.



According to a statement from PSA and Fiat Chrysler Automobiles when they formed Stellantis in 2021, the word 'Stellantis' comes from the Latin verb 'stello' which means 'to brighten with stars'.

The logo for Stellantis, featuring the word "STELLANTIS" in a white, sans-serif font. The letter "L" is stylized with a cluster of white dots of varying sizes, resembling a star or a galaxy, positioned behind it.

Stellantis reaching for the data star

STELLANTIS USED CES 2023 to announce a new data services business called *Mobilisights*. (I believe that the 'i' between 'l' and 's' is going to give folks trouble; *Mobilesights* or *MobilSights* would have been preferable, but CEO Carlos Tavares didn't ask me for my opinion.)²⁴ This is part of its plan to generate €20 billion from software-related activities by 2030 that Tavares announced in December 2022. The CES announcement was made by Sanjiv Ghate, *Mobilisight's* CEO. He told reporters that the business would help to reduce accidents by relaying information about road hazards, and also allow insurance products to be better tailored to STELLANTIS drivers. And this data could also be licensed to other vehicle manufacturers.

I can hear the exasperated sighs of many of you when you read this. Automakers have been saying stuff like this for the past thirty years, and setting up data services businesses for at least that long. Where are they today? Think of BMW's and Daimler's *Moovel* and Volvo's *M*. Is there something else that *Mobilisights* will do that will be different?

Free2Move, which was introduced in the U.S. as a mobility services brand by PSA before PSA, along with Fiat and Chrysler became part of STELLANTIS in 2021, is going to be incorporated into *Mobilisights*. I wrote about this in the [November 2017 issue of The Dispatcher](#). There has been radio silence about the business since it was announced. So there will be car sharing and other mobility-as-a-service services. It will have "three digit" numbers of employees by the end of this year, said Ghate. "It has to be independent," explained Ghate, "because there must be a clear separation between car owners and the organization processing their data." Switching to GDPR-speak, he said: "I'm a data processor, not a data controller. That's important. What the business unit receives from the mothership is already consented for (*Ed: quoting directly*)."

²⁴ https://www.autonews.com/ces/stellantis-creates-new-data-services-business?utm_source=daily&utm_medium=email&utm_campaign=20230106&utm_content=article4-headline

Winters can be cold; BEVs like it hot

TESTS HAVE SHOWN that the range of battery electric vehicles can be dramatically reduced in cold winter climate regions, and that what a BEV actually delivers differs greatly from what the manufacturer promises. This is a problem, say Sweden's automobile association, MOTORMÄNNENS RIKSFÖRBUND, known now simply as **M Sverige**, and its Norwegian counterpart, *NORSKA MOTORFÖRBUNDED (NAF)*. They strongly recommend that the actual range for cold weather operation should be made known to drivers to minimize overly optimistic planning of trips that could result in running out of energy where there is no possibility for re-charging.

Results of the tests performed with several brands and models by the motoring organizations shows that range loss can be over 25%. This occurred in spite of the cars being warmed up prior the start of the trip, which means the loss can be even greater with cold starts. *"We believe that the manufacturers should be required to state how much range can vary with drops in temperature. Now, drivers have no idea what to expect,"* says Carl-Erik Stjernvall, technical expert with M SVERIGE. *"Perhaps the consumer does not expect any difference in range depending on temperature, and consumers should not be expected to have such knowledge. On the contrary, it is up to the manufacturer to give an account of the car's characteristics."*

In recent years, Sweden's CONSUMER PROTECTION BOARD (ALLMÄNNA REKLAMATIONSNÄMNDEN) has received few complaints from consumers who believe they have received too little information on their vehicle's range when they purchased their vehicle. There is a risk that with the increasing number of people buying their first BEV, people who are not among the early enthusiastic adopters of electric car technology, that there will be a large increase in complaints. It should not be the consumer's job to find and read the various tests that exist on the net, and there is no certainty that the tests that are published are thorough and accurate, says Stjernvall.

It's not just BEVs. We purchased a *Toyota RAV4 Hybrid* (ICE and battery, no cables) and took delivery of it in August 2022. Before the temperatures dropped below zero Celsius, we were averaging 5.4 liters/100 kilometers. Since early December, when the thermometer dropped into the below zero zone, we have averaged around 5.9 l/100 K.

NISSAN SWEDEN'S director of communications, Charlotte Thulin, commented on the report in an email to Swedish TV. She said that both consumers and auto companies would be served if there was a *World Harmonized Light Vehicles Test Procedure (WLTP)* that provided comparable fuel/energy usage figures for cold climates, independent of whether the vehicles are battery electric-, hybrid- or internal combustion-based. The *WLTP* is a global standard for determining the levels of pollutants, CO₂ emissions and fuel consumption of traditional and hybrid cars, as well as the range of fully electric vehicles. That sounds like a very good idea.

Volvo, Geely, and Zenseact

IF YOU WANT to know whether to invest in a company's stock, don't ask one of the company's competitors—especially not one that has proven to be known for bending the truth. That was my thought when I read on the *Teslarati* (what an annoying name) site that 'Volvo' was entering the autonomous driving market via a company acquisition.²⁵ The company supposedly being acquired is ZENSEACT. There is only one problem with this announcement. **VOLVO CARS** (not VOLVO, which might be confused with VOLVO GROUP, the company that sold VOLVO CARS to FORD back in 1999) **founded ZENSEACT in 2020**. VOLVO CARS sold a 15% stake in the company to a Chinese company called ECARX (pronounced eee-car-ex) back in 2021. It is simply buying back that 15% so that ZENSEACT is once again a wholly-owned subsidiary of VOLVO CARS, so it's rather ridiculous to say that VOLVO was "entering the autonomous driving market", as if it is finally realizing that it has to follow the leader, which is obviously TESLA (for clarity, I am being ironic).

At the center of all of this hocus-pocus is none other than ZHEJIANG GEELY HOLDING, which bought VOLVO CARS from FORD in 2010 and owned 100% of it until VOLVO CARS' IPO in October 2020. Now GEELY owns 'only' 85% of VOLVO CARS. ECARX was founded in 2017. The co-founders were Ziyu Shen, who became Chairman and CEO of the company, and Eric Li (who is still known at home in China as Li Shufu), Mr. Li is the founder and chairman of ZHEJIANG GEELY HOLDING GROUP, which has ownership positions in VOLVO CARS, LOTUS, LYNK & CO, POLESTAR, SMART, DAIMLER, among others. ECARX completed an IPO in December 2022 in a merger with COVA ACQUISITION COMPANY. The ECARX/COVA transaction values ECARX at \$3.82 billion pro forma equity value. Proceeds of the transaction, which are estimated to be \$300 million held in trust by COVA and

Håkan Samuelsson, CEO of Volvo Cars at the time of its IPO, rings the NASDAQ Stockholm bell to open trading on its stock.



²⁵ <https://www.teslarati.com/volvo-enters-autonomous-driving-market/>

\$45 million in capital from various partners, including GEELY HOLDING GROUP, are intended to enable ECARX to grow and make acquisitions.²⁶

ECARX announced in July 2021 that it was making an investment in ZENSEACT that would give it 15% ownership of the subsidiary. The stated aim of the investment was to “strengthen ZENSEACT’s presence in China, and allow it to accelerate technology deployment in China and across the GEELY GROUP of brands”. Samuelsson said at the time that it would give ZENSEACT a “clear way to grow more quickly”. VOLVO CARS and ECARX already had in place a collaboration on Android-based infotainment.

ZENSEACT itself was created after ZENUITY was dissolved in April 2020 after only three years of operation.²⁷ ZENUITY was a joint venture between VOLVO CARS and VEONEER (or between each company’s parent company, respectively GEELY and AUTOLIV). ZENUITY was formed to develop and commercialize “unsupervised autonomous driving software”. It was closed because “expectations for the launch of fully autonomous driving were pushed back”, and VOLVO decided that it would focus on advanced driver assistance systems that help the driver without taking full control of the car. At the time of the closing it was announced that ZENUITY’s operations and around 600 employees based in Sweden and China would be transferred to a new company formed by VOLVO. This company turned out to be ZENSEACT.

Does the buy-back by VOLVO mean ZENSEACT does not, after all, need to have ECARX to expand in China, or that ECARX did not deliver the expected advantages, or that the tie-up achieved its purpose of promoting each of the companies prior to their IPO? Whatever the reason, the two companies remain partners within the GEELY sphere, and will continue to support each other and all of the other companies within that sphere. ZENSEACT will continue to do what it and ZENUITY have been doing for a lot of years, while TESLA was still wet behind the ears.

Quick Transactions

Magna buys Veoneer ADAS

I WROTE ABOUT VEONEER and its suiters in the [October](#) and [November](#) 2021 issues of *THE DISPATCHER*. MAGNA made a \$31.25 per share

²⁶ <https://finance.yahoo.com/news/ecarx-public-3-82-billion-110000170.html>

²⁷ See the May 2020 issue of The Dispatcher for the story of Zenuity’s breakup. http://www.michaellsena.com/wp-content/uploads/2020/04/The-Dispatcher_May-2020.pdf

offer to acquire VEONEER in July 2021, which was accepted by VEONEER's board. However, when QUALCOMM countered with a \$37 per share offer, that is what VEONEER accepted. VEONEER paid MAGNA \$110 million in breakup fees, and SSW PARTNERS made the acquisition on behalf of QUALCOMM so that QUALCOMM could take the only part of VEONEER it wanted, VEONEER's *Arriver Sensor Perception and Drive Policy Platform*, and SSW could then sell what was left.

We are now beginning to see why *Arriver* is so important to QUALCOMM. VEONEER and QUALCOMM had signed an agreement in January 2021 to create *Arriver* that would be owned 100% by VEONEER. When VEONEER went up for sale, there was too much risk that whoever bought it would either not be able to support the product at the same level as VEONEER, or it would find it more in its interest to market it to competitors of QUALCOMM. I wrote in the November issue that "MAGNA will likely be interested in picking up the (leftover) pieces if the pricing is right". Presumably, it was. MAGNA announced in December that it would be acquiring VEONEER's former *Active Safety* business from SSW PARTNERS for \$1.525 billion in cash. MAGNA stated that it estimated the addition of VEONEER's *Active Safety* would generate approximately \$3 billion in sales in 2024, making MAGNA's ADAS business. It will add 2,200 Veoneer engineers to Magna's staff, including 1,800 for systems, software and sensor development.

Here's what Magna's CEO, Swamy Kotagire has to say about the deal: *"This acquisition is consistent with our Go-Forward strategy to accelerate investment in high-growth areas, strengthens our ability to deliver systems solutions to meet customer needs, and positions Magna as a leading full-service ADAS provider. We plan to accelerate innovation by building on both organizations' strengths, including customers, suppliers, technology partners and employees. I am excited to welcome Veoneer Active Safety's talented employees into our global Magna family."*²⁸

Elon Musk sets another record

HERE'S THE HEADLINE in *CNN BUSINESS* on the 3rd of January 2023: **"Elon Musk has lost a bigger fortune than anyone in history."**²⁹ No one had ever lost \$200 billion in net worth before Musk achieved this feat. That net worth is principally bound to TESLA's

²⁸ <https://finance.yahoo.com/news/magna-acquire-veoneer-active-safety-100000711.html>

²⁹ <https://edition.cnn.com/2023/01/02/investing/elon-musk-wealth/index.html>

share price, and when the share price falls, as it has been doing during 2022 by 65%, Musk's net worth falls with it. One of Musk's former fans and one of the company's largest individual shareholders, Loe Koguan (who, it is said, once called himself "Elon's fanboy"), wondered aloud if his fallen idol was pushing down the price of TESLA's stock on purpose. On Friday, the 6th of January 2023, TESLA's stock was trading at \$105 per share, its lowest price since the 12th of August 2020.

Why would Elon do this to himself? Koguan offered the following reason in a Tweet: "...he purposely crushed TESLA stock price and its shareholders for his tax benefits and potential new stock options granted by himself because he is both the CEO and the Board of Directors. Fund Managers of TESLA, are you listening?" One of those managers responded. Alex Lagetko, founder of VSO Capital, said that he believes Musk "would benefit from sandbagging financial results manifested in underreporting sales and profits. Because Musk achieved all market cap milestones in 2021 (which he set to trigger his payouts), he no longer had any incentive under the compensation plan to maximize shareholder value. He had every incentive to see the stock lower (for tax reasons) or to pursue personal aspirations (purchasing TWITTER) knowing he had a massive slug of fresh options coming which he could exercise when the shares are trading as low as possible."³⁰

There may have been other times in history when a company that became so valuable and such an important influence on the fate of an entire industry was totally controlled by and subject to the whims of a single individual. If there was such a company, it would be interesting to know what happened to it so we could have some idea of what will happen with TESLA. Just one year ago, TESLA's market cap topped \$1.2 trillion. Remember what a big deal everyone made of the fact that AMAZON and APPLE hit \$1 trillion in 2018 within five weeks of each other? This was more than most automobile companies put together. Since then, it has shed 71% of that value. It is down to \$390.17 on the 13th of January, which is still almost double TOYOTA's, the auto company with the second highest valuation.

TESLA is no longer alone in the world of BEVs, it is no longer being viewed as a tech company, rather than a car company, and its

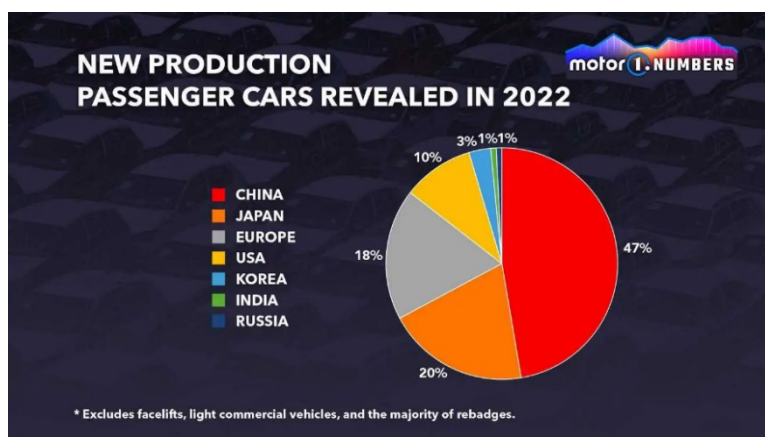
³⁰ <https://www.businessinsider.com/tesla-investor-leo-koguan-accuses-elon-musk-tanking-stock-price-2023-1?r=US&IR=T>

CEO is no longer treated like he walks on water as he is often pictured these days sinking into the TWITTER quicksand. Still, it delivered 1.3 million cars in 2022, 40% more than the previous year. Some companies (do I need to mention Volvo Cars?) have yet to reach the 1 million mark.

China Inc. global automobile monopoly update

THE NEWSPAPERS AND online feeds are filled with announcements of new models coming out of China. Since China decided to become an automobile manufacturing powerhouse more than twenty years ago, the number of companies producing cars and trucks has grown as it did in the United States in the early 20th century. The big difference between the two countries is that in the U.S. there were only independent manufacturers, while in China there are state-owned manufacturers, and joint ventures between foreign and both independent and state-owned companies, competing with the independent companies. There are over 600 firms now manufacturing cars in China, and around 450 of them are making electric cars, either pure battery electric, plug-in electric or hybrid.

Car buyers in the two other major car manufacturing markets, North America and Europe, had no reason to care about Chinese car companies for most of those twenty years because the Chinese cars were not qualified to be sold in the western countries. That changed a few years ago, and the policy push by governments in the U.S. and EU to force consumers to buy battery electric cars, particularly those without a supplemental internal combustion engine (ICE), accelerated the number of companies and models being exported from China into western countries. According to a report prepared by the U.S. company MOTOR1.COM, Chinese cars made up almost one-half of all cars introduced during 2022.³¹



There were 131 new cars unveiled in 2022. This includes all production cars presented to the public worldwide, but excludes rebadged models, facelifts and concept cars. Of this number, 62 (47%) were produced by Chinese manufacturers. SAIC was behind

³¹ <https://www.motor1.com/news/628768/chinese-cars-almost-half-new-cars-revealed-2022/>

10 of those models, Geely had 8 and Great Wall 6. Chinese brands reporting double-digit or greater sales increases in Europe during December include MG, BYD, Nio, Hongqi, Maxus, Aiyways, Xpeng and Great Wall.

One western auto boss has noticed and has been warning about this sino threat for some time. Carlos Tavares, CEO of Stellantis, used *CES 2023* to deliver his message.³² He said that if politicians in Europe do not find an answer to the push into Europe by Chinese automakers, there will be a “terrible fight”, resulting in Europe’s auto industry being forced to “massively reduce its production capacity in the face of rising competition from China,” said Tavares. The problem is that China is doing with cars what it has done with everything else, pricing them well below current market prices. Tavares says that the difference in prices is “significant”, and if nothing is changed, European customers from the middle class will increasingly turn to Chinese models. This situation is exacerbated by the inflationary price increases caused, in large part, by COVID-19-related parts shortages.

Tavares went further and addressed the issue that this newspaper has been writing about for the past three years: the EU’s emissions regulatory regime is not helping the region’s automakers. “Regulation in Europe ensures that electric cars built in Europe are about 40% more expensive than comparable vehicles made in China,” said Tavares. “I think we’ve seen this movie before. It’s a very bleak scenario. But it doesn’t have to go that way,” said Tavares. He pointed to SAIC's MG, BYD, GEELY's *Zeekr* and Nio as the main Chinese automakers targeting European consumers with their electric cars.

China has placed Europe exactly where it wants it. China has allowed European car companies to make China its largest single country market. If the EU restricts Chinese sales in Europe, China can close down the Chinese market for VW, BMW, MERCEDES-BENZ and all the other western companies. Since exports are still small for the Chinese companies, an EU ban on Chinese car imports would have only a minor effect on Chinese companies, but a major one on its own companies, especially the German companies. Tavares is a solitary voice among automotive CEOs.



³² https://europe.autonews.com/automakers/stellantis-ceo-tavares-warns-terrible-fight-chinese-automakers?utm_source=daily&utm_medium=email&utm_campaign=20230106&utm_content=hero-headline

About Michael L. Sena

Through my writing, speaking and client work, I have attempted to bring clarity to an often opaque world of highly automated and connected vehicles. I have not just studied the technologies and analyzed the services. I have developed and implemented them, and have worked to shape visions and followed through to delivering them. What drives me—why do what I do—is my desire to move the industry forward: to see accident statistics fall because of safety improvements related to advanced driver assistance systems; to see congestion on all roads reduced because of better traffic information and improved route selection; to see global emissions from transport eliminated because of designing the most fuel efficient vehicles.

This newsletter touches on the principal themes of the industry, highlighting what, how and why developments are occurring so that you can develop your own strategies for the future. Most importantly, I put vehicles into their context. It's not just roads; it's communities, large and small. Vehicles are tools, and people use these tools to make their lives and the lives of their family members easier, more enjoyable and safer. Businesses and services use these tools to deliver what people need. Transport is intertwined with the environment in which it operates, and the two must be developed in concert.



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