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The Apple car: could the rumours be true?

Apple car rumours take shape | **QuantumScape** readies for solid-state battery ramp up | **Spin** pushes for micromobility infrastructure | **Mazda** incorporates connectivity into wider brand strategy | **Moovit** sheds light on post-pandemic mobility | **Sense Photonics** offers game-changing approach to LiDAR

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Apple-Hyundai proposal seen as a win-win

Partnerships between tech companies and traditional automakers once seemed dubious at best. Recent trends suggest otherwise, writes Freddie Holmes

In a tale that has rolled on for more than five years, recent reports would suggest that Apple's effort to make electric vehicles (EVs) may be more fact than fiction.

Internal plans to commercialise an electric passenger vehicle in 2027 were leaked by Korean media in December. These plans were tentatively confirmed later in January; Hyundai, the automaker that would allegedly make these vehicles, told the *Financial Times* on 8 January 2021 that it was in "early stage" discussions but that "nothing has been decided."

The Korean automaker added that it was one of many manufacturers in conversation with Apple, which has been courting others in pursuit of a co-developed vehicle.

Rumours of an Apple car kick up a veritable media storm, but in today's environment the latest developments are not particularly surprising. The automotive industry is in flux: internal combustion engines (ICEs) are on the way out; autonomous driving technology is becoming increasingly advanced; consumer thirst for connected and digital experiences has never been higher; and a fertile start-up ecosystem means competition is emerging on a daily basis. If ever there were a time to launch a new car company, it is now.

"It makes perfect sense for a company like Apple to partner with an automaker," says Karl Brauer, a seasoned industry analyst and Executive Publisher of CarExpert.com. "Building the car of the future is going to require merging advanced technology with traditional manufacturing. Apple clearly excels at one of those, while automakers have the existing infrastructure for the other."

This emerging trend was recently explored in *Automotive World*'s December special report: 'Will tech giants ever become automakers?', which investigated whether vehicle production makes sense for companies such as Apple, Amazon and Google.

Best of both worlds

If developments continue as expected, Apple would not be the only tech company to forge an alliance with an established automaker.

In China, internet giant Baidu recently announced a partnership with Geely to create a new electric car company. The deal will see both companies perform joint research and development activities to produce 'intelligent and connected EVs.' The vehicles will be based on Geely's new EV architecture known as SEA (sustainable experience architecture), which was revealed in September 2020. Baidu will bring its expertise in autonomous driving and navigation.

"In terms of the tech companies' contribution to a co-developed car, the vehicle's intelligent-driving capabilities will matter the most," says Arushi Kotecha, a Research Analyst at the Economist Intelligence Unit (EIU). "What Apple and Baidu can share with Hyundai and Geely, respectively, is sure to be more sophisticated than what the automakers could build on their own." Autonomous driving in particular has been driven by the start-up community, and many companies have been absorbed by tech giants. In December, Baidu Apollo was awarded licenses to test its autonomous test vehicles on public roads in Nanjing, a large city 200 miles west of Shanghai. Apple holds a permit to test automated vehicles in California, and is also reportedly developing its own battery technology.

As the parent company of Volvo Cars, Lynk & Co and LEVC, as well as lead shareholder in Proton and Lotus, Geely makes for a powerful ally. It brings not only manufacturing scale and expertise, but also a sterling reputation for quality that Baidu might otherwise lack in the automotive sector. "The responsibility for automotive design and production will lie with carmakers, who have the necessary experience," explained Kotecha.

Then there is the proposed joint venture between Foxconn—a Taiwanese electronics manufacturer that assembles the iPhone—and FCA. Announced in January 2020, the deal would see the pair leverage their respective strengths; FCA confirmed a 'proposed cooperation' in a statement that month. Foxconn has broached the idea of becoming a supplier to various automakers, and in October revealed MIH, an 'open platform' that could underpin numerous EV models. This, it said, demonstrates Foxconn's "commitment in the transformation of the traditional automotive industry." It plans to commercialise a solid-state EV battery technology by 2024.

Waymo has forged technology sharing partnerships with FCA and Jaguar Land Rover, but it has ruled out the production of its own passenger cars. Firefly, its driverless pod, was its first effort to produce an own-brand vehicle, but this has remained a working concept.

Approach with caution

The expectation has long been that tech companies could move into the automotive sector, but question marks have lingered around the fundamentals: would they build and operate their own factories; how would they gain the necessary

> A car co-developed with a tech company offers the best of both worlds

expertise in vehicle technologies; and would consumers buy them? Many of those concerns go away with an established manufacturing partner, be it a contract manufacturer or an existing automaker.

The business model remains murky, and it is unclear exactly how tech giants would fare against existing manufacturers with decades of experience under their belt. A partnership between the two sides would arguably work in favour of the tech company, which might otherwise have no feasible route into the new vehicle market. But what about the brand on the front and rear of the car—would an Apple, Amazon or Baidu logo capture the attention of buyers? The EIU's Kotecha suggested that consumers are likely to be receptive.

"A car co-developed with a tech company offers the best of both worlds," she explained. "Such collaborations will become more commonplace and help automakers position their cars as more premium and aspirational. From the tech giants' perspective, such partnerships are an easy way to get their foot in the door in the explosive EV market without the need to invest in car production and suffer from chronically low profit margins like automakers."

CarExpert's Brauer is of a similar opinion, and expects the automaker-tech company trend to continue. "Ultimately, we'll see tech companies and car companies aligning across both industries, up to and including a full merger in some cases," he suggested. "The companies that start this alignment early will have an advantage in bringing advanced vehicles to market first."

The attention that the Apple-Hyundai story has attracted suggests that consumers would indeed be interested. At this stage, there remains very little hard evidence to work with. Aside from Hyundai's confirmation that Apple is shopping round, speculation remains the primary source of information on Project Titan.

CES shines spotlight on post-pandemic mobility priorities

Megan Lampinen reports back from the virtual show floor

Rapid technology advances are reshaping the mobility landscape, and the pandemic has done little to slow the pace of change. However, it could redirect it. "This is a question of consumer behaviour and how it will influence future business models," says Steve Koenig, Vice President of Research at the Consumer Technology Association (CTA). "That question should see some answers at CES."

Of the CTA's list of Tech Trends to Watch this year, vehicle technology, 5G and smart cities appear in the top six. "Obviously these three areas are tightly interconnected to each other and progress in one area will be reliant on–as well as a spur for–progress in another," says Randy Miller, Global Automotive and Transportation Sector Lead at EY. "This is going to be an interesting area to watch in 2021."

CES 2021 offers some interpretations of what the mobility ecosystem could look down the line, but just as importantly it demonstrates the resilience and ingenuity that automotive players will need to successfully navigate both near- and long-term challenges. The show floor was a virtual one, but the technology under the spotlight was very much designed to solve real world problems.

Here and now

COVID-19 continues to spread in many parts of the world, with hospitalisation and death rates on the rise. One of the most immediate challenges it poses is to the public transport and shared mobility sectors, both of which have been hit hard in its wake. Demand for clean and healthy transportation environments could be the new normal. Players here have been tackling concerns through a combination of digital booking apps to ensure social distancing and disinfectant technology.

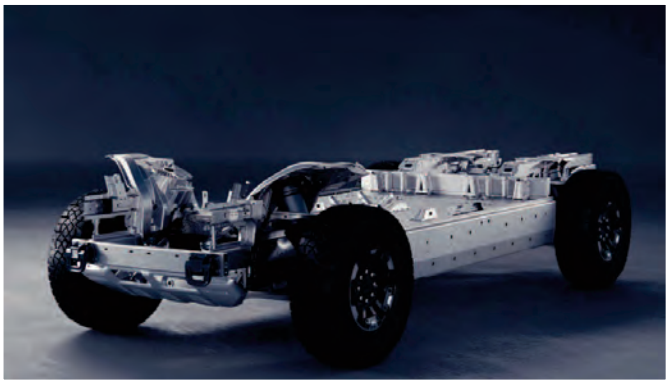
"In response to this challenge a desire for cleanliness was definitely on display at CES," EY's Miller tells *Automotive World*. LG showed off an autonomous UV-C robot that can eliminate viruses on surfaces as well as portable air purifiers. For mass transit and shared mobility in particular, Miller suggests that "an increase in air quality and ability to autonomously clean services could be a key component in bringing these areas back to the forefront." He anticipates a huge amount of interest in this area in the next 12 months.

LG autonomous UV-C robot

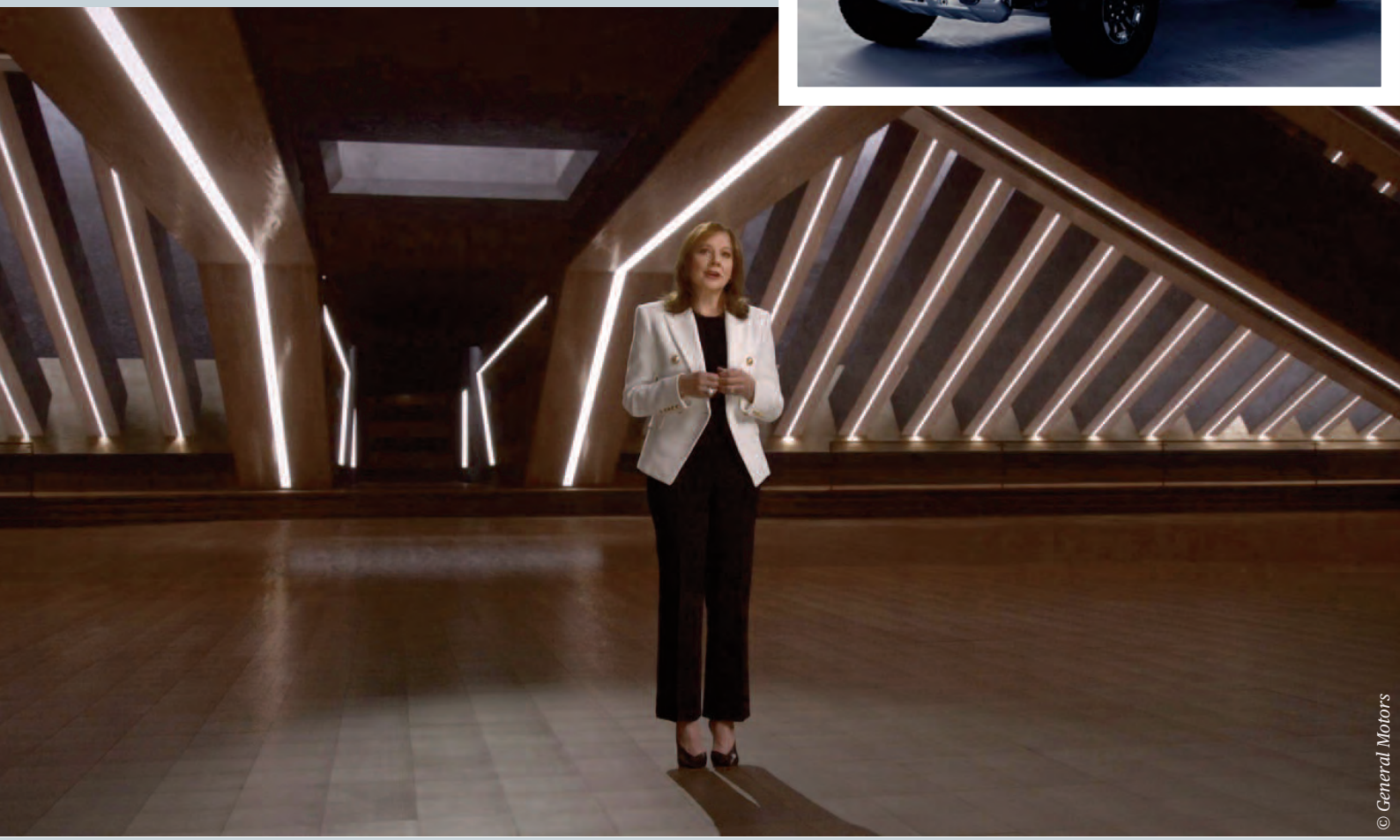
Near-, mid- and long-term visions

The keynote from General Motors' Mary Barra is a case in point. "Unlike other companies that have fallen into the CES keynote trap of focusing on a future that seems light-years away, GM clearly laid out a vision that included a solid mix of future ambitions with more immediate products and plans to back them up," says Jessica Caldwell, Executive Director of insights at Edmunds.com. Frost & Sullivan Research Director Niranjan Manohar makes a similar observation: "GM was the only automaker that made sure to touch upon all aspects of mobility by showcasing near-, mid- and long-term visions."

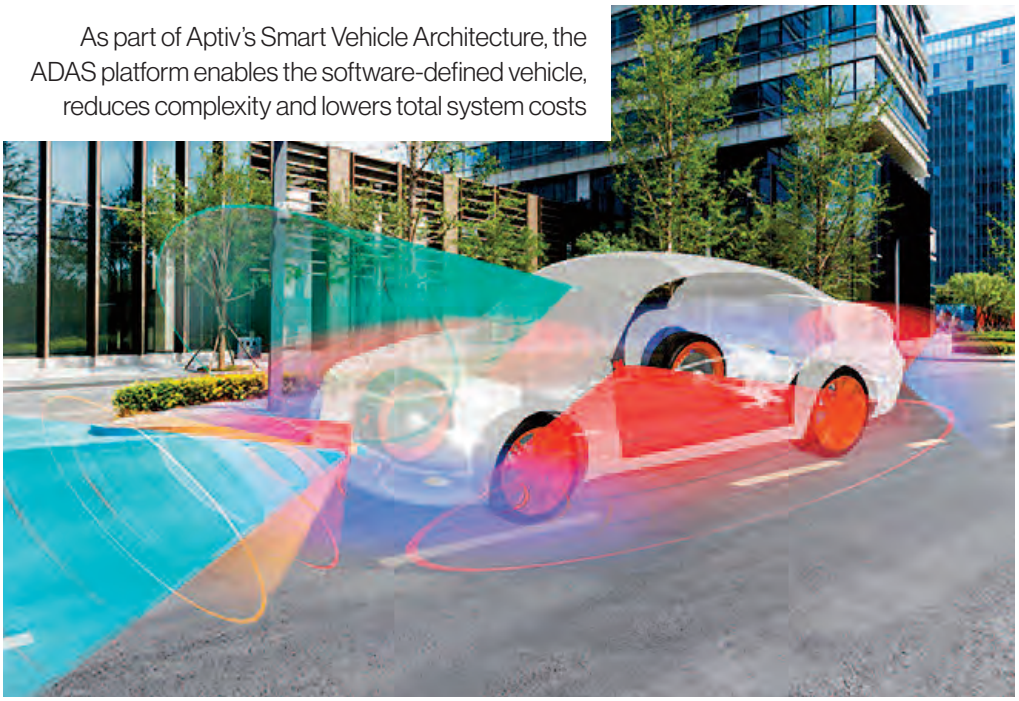
Barra's address zeroed in on the role that electrification would play in realising GM's vision of a world with zero crashes, zero emissions and zero congestion. Along with electric models from Cadillac and Hummer, the automaker announced a new business, BrightDrop, devoted exclusively to electric first-to-last-mile products, software and services. While these are all very much destined to appear on the market soon, GM also threw in a glimpse of a flying Cadillac pod to balance things out. "It was refreshing to see the



GM's Mary Barra delivered a keynote address touching on both near- and long-term projects



As part of Aptiv's Smart Vehicle Architecture, the ADAS platform enables the software-defined vehicle, reduces complexity and lowers total system costs



© Aptiv

company unveil new vehicles and technologies that will be available to car shoppers as soon as this summer, as opposed to more pie-in-the-sky ideas—although it wouldn't be a CES keynote without at least one mention of a flying vehicle," adds Caldwell.

That's not to say that the industry is moving away from long-term visions, though. Aptiv's Chief Technology Officer, Glen de Vos, suggests COVID could be partly behind some recalibration in the timing of technology roadmaps. "That vision is still very much in place, though the path to getting there can change in terms of both timing and how it's done," he tells *Automotive World*. While he describes the recent acceleration around electrification developments as impressive, de Vos concedes there has "been a little bit of re-timing on areas such as Level 3 automation. That said, the interest in Level 2 and 2+ has stayed very strong. In fact, if anything, it's grown."

Aptiv's virtual presentation this year centred on its next gen ADAS platform, designed to cost-effectively scale across Level 1 through Level 3 automated safety features, and the zone controllers that can simplify the supporting electrical architecture. It also ties in with electrification. As de Vos points out, "The move towards electrification creates an opportunity for the automaker to rethink the electrical and software architecture on the vehicle."

Many of the displays at this year's event touched in some way on environmental and safety concerns. The message from management teams is that they plan to tackle these with all the engineering and technical know-how they have. As Barra concluded in her media address, "If the ambition, talent, and technology does not add up to a safer world for us all, it is not better."

The experience

Automakers and regulators may be bullish on the prospect for electric vehicles (EVs), but some drivers still

Many companies, including Harman, are presenting concepts for an immersive in-vehicle experience

© Harman

need convincing. The industry has seen increased efforts around conveying to consumers what the EV experience looks like and just how easy it is to switch. “Right now, consumers are sceptical that it will make their lives better,” says Alyssa Altman, a seasoned CES veteran and lead automaker consultant, and transportation lead at Publicis Sapient. “The work that is being done is making EV ownership mainstream. Right now, Tesla owners are a fan base, the goal is to have many options and more accessible ways to charge to make it more about ‘I want what my neighbour has in the driveway’ versus being an early adopter.”

Most of the customer experience announcements, however, were focussed on the in-vehicle experience. Samsung displayed an innovative digital cockpit that promised immersive entertainment on-demand, while Harman once again showed off different concepts for a multi-modal experience using its ExP technology suite. Its Gaming Intense Max concept offered a vision of immersive gaming harnessing a 5G telematic control unit and the Ignite automotive cloud platform.

Occupants will not just be gaming in the car of the future, they will also be making purchases. Gentex has teamed up with PayByCar to offer contactless in-vehicle payments for parking and fuel, while FCA has partnered with Grubhub to enable riders to place contactless food orders via Uconnect Market. This year also continues the focus on health and wellbeing, with particular interest on driver and occupant monitoring. Samsung's digital cockpit, for instance, can monitor the driver's stress levels and adjust lighting and music in response.

"There is an opportunity for automotive to be the 'cockpit' or 'central nervous system' of everyone's life, no matter if they have their own car, like to bike, use ride-share, or are receiving a delivery," says Altman. "The capabilities to improve the environment based on body temperature, change the dash based on conversation and motion and navigate a safe environment efficiently however you are moving, are all in the works. If architected as the centre of our experience and linked to our phone, it could be accessible to all people and change the way we interact with each other."

Going virtual

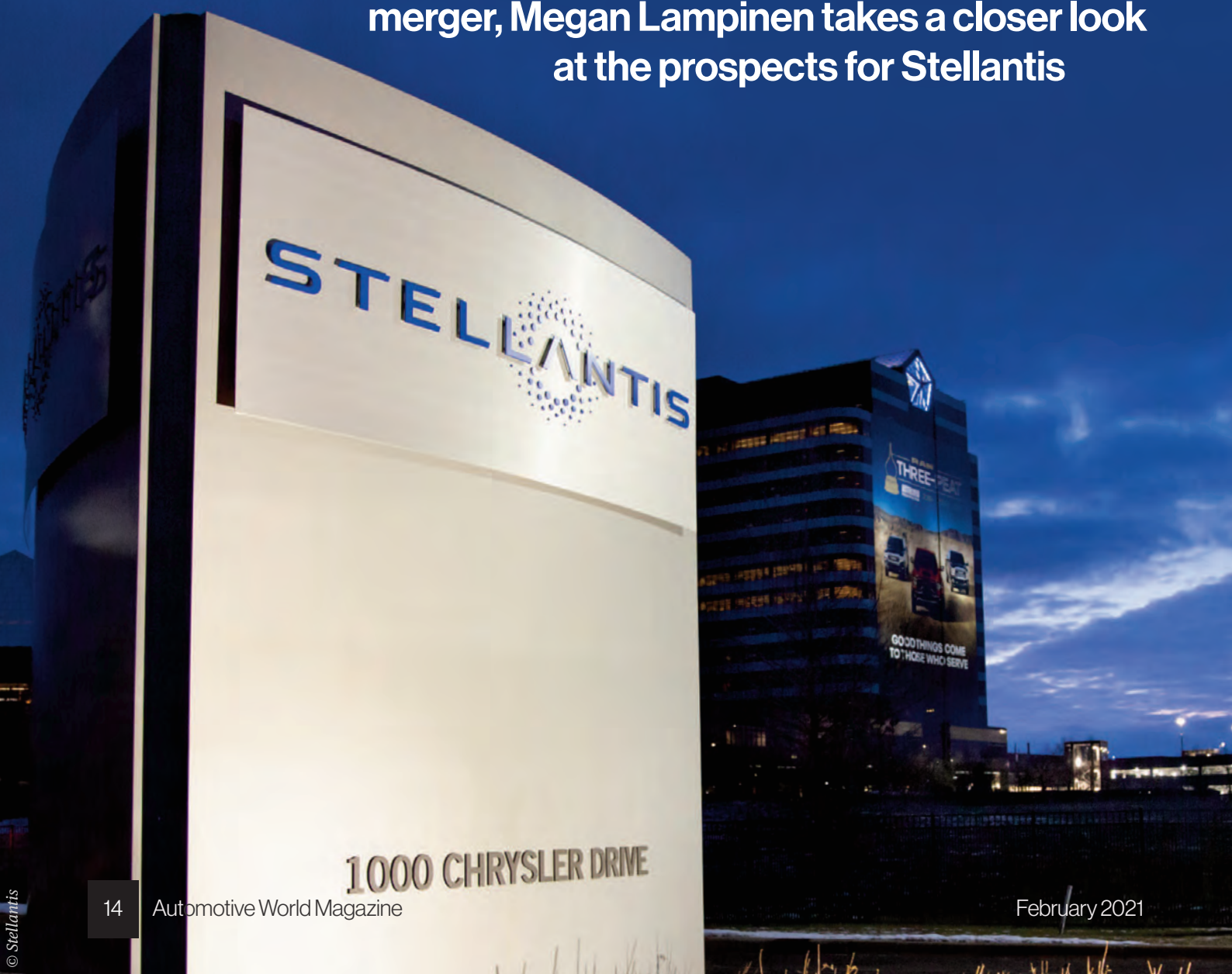
Contagion concerns have forced events like CES to either cancel entirely or go digital. The shift to a virtual platform has proven popular, though this jury is still out on how it compares to traditional face to face gatherings. "The good side of it is that we could watch when we had the time to focus," says Altman. "What was missed is the exciting energy of being in the ballroom or exhibition hall when new concepts are launched and new ideas shared... CES is also a meeting point for people to connect with clients and partners to learn together, talk about new ideas, and get to know one another socially. This was definitely lost this year." Aptiv's de Vos describes CES as the suppliers' most important conference as it offers a hub to touch base with customers, tech partners, investors, suppliers and media. "It's probably the richest event that we have. Now, that's missing."

> "It wouldn't be a CES keynote without at least one mention of a flying vehicle

However, there are also learnings to come out of this alternative format. Many participants highlight the adaptability that companies have shown, which has spilled over from changes to the day-to-day working environment and communication models. And a big plus was the wider exposure made possible by the digital format. Aptiv reports back that it recorded "a high density of engagements" despite the lack of in-person meetings. Altman notes that "accessibility to content is critical and however CES moves forward, making it accessible to a larger virtual audience will be key."

Will Stellantis' corporate reset serve as an industry blueprint?

With shareholder approval now secured for the PSA/FCA merger, Megan Lampinen takes a closer look at the prospects for Stellantis



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It's official, a new mobility giant is on the way. After months of deliberation, FCA and PSA shareholders have overwhelmingly approved merger plans to create the new company Stellantis. Plans for this "new world leader in the automotive sector" were first announced back in December 2019. Final regulatory approval has since come in from the European Commission and the European Central Bank, and shareholders have voted overwhelmingly in support or the proposal, with 99% in favour. Stellantis will officially begin trading on the Euronext in Paris and on Mercato Telematico Azionario in Milan on 18 January 2021, following one day later on the New York Stock Exchange.

This is no average newcomer to the mobility stage. Stellantis draws on more than a century of experience from both its parents. It will become the third largest automaker in the world in terms of revenue, and the fourth largest as measured by volume. That gives it a solid base, but how will it fare from there?

A corporate reset

"Scale is an important element in profitability," says Jean-Dominique Bonnet, Principal Consultant, Commercial Vehicles/Intelligent Mobility at Frost & Sullivan. "The top groups right now have capacity to build about 10 million vehicles per year. The key to accommodating this volume is through platforms."

One of the benefits of this merger is that it will allow the partners to share long-term platforms across a number of different vehicle segments, thereby saving significantly on development costs. The partners anticipate that the merger will yield yearly industrial synergies or more than €5bn (US$6.15bn), with approximately 75% of those from technology, procurement, platform and product convergences.

"This merger really tackles the volume aspect, but there are a couple missing pieces that may prevent them from making the most out of it," Bonnet tells *Automotive World*. For example, both PSA and FCA have several platforms of their own. Before realising the benefit of scale they will need to move to a common platform, and this could take time. "The start of Stellantis marks the premise for something, but the benefits will not be immediate," he adds. "It could take another five years for them to develop."

Notably, work on platforms could harness the trend towards low- and zero-emission technology. "Both FCA and PSA were a little bit late on electrification, but that could prove a good thing," says Bonnet. "Now they have the ability to start together afresh on something jointly."

Analysts at Jefferies express similar optimism that the new company will offer a clean slate approach at a pivotal juncture in the industry's green evolution. "We see the creation of Stellantis as an opportunity to reset priorities and shape the group at a critical time if we are right about an acceleration of EV adoption," they write in a recent investors note. They add that "initial caution from both sides about keeping EVs to a compliance minimum" has since shifted and more assertive action is being pursued.

> We see the creation of Stellantis as an opportunity to reset priorities and shape the group at a critical time

Kaushik Madhavan, Vice President, Mobility Practice, Frost & Sullivan, expects to see increased investments particularly around multi-energy platforms. “The development of ‘skateboard’ electric platforms will receive a significant boost as both OEM groups look to leverage combined volumes to make electric vehicle offerings more attractive,” he notes. “Additionally, this will also offer Stellantis the opportunity to develop dedicated platforms for shared mobility, and eventually autonomous offerings.”

Market adjustments

Volumes drive scale, but go too far with capacity and costs begin to bite. FCA has overcapacity issues to address in certain markets, including Europe and India. “As the merger re-looks at capacity utilisation across the regions, there is an expected rationalisation of capacity and sharing of manufacturing lines to roll out alliance models,” says Madhavan. “With investments in flexible manufacturing, this merger is expected to increase utilisation in key regions globally.”

Market coverage is another key area for improvement. In fact, some pinpoint this as the main benefit of the merger. “The logic of the merger is less about size, which may be less critical than in the past, than market coverage,” write Jefferies analysts. PSA enjoys a solid position in Europe while FCA is stronger in North America. Going by the combined financials from 2019, and excluding Faurecia, the partners expect 46% of revenue to stem from the Europe, Middle East, Africa and Eurasia region, with 44% from North America.

Brands and governance

Managing the brand portfolio will be another key strategic priority. Stellantis is the corporate brand identity that will encompass all the individual brands within FCA and PSA. Reminiscent of the Volkswagen Group multi-brand conglomerate, Stellantis includes a total of 16 automotive brands: Peugeot, Citroen, DS, Opel, Vauxhall, Abarth, Alfa Romeo, Chrysler, Dodge, Fiat, Fiat Professional, Jeep, Lancia, Maserati, Mopar, RAM and SRT. Jefferies has

described the portfolio as “a mix of mostly regional brands with core franchise strength but relatively low premium exposure.”

Not all of them may stick around for long. “I am not saying that they need to consolidate, but I think FCA and PSA will have to trim some brands,” predicts Bonnet. Deciding which ones should go will be tricky. “I don’t think you can very easily limit the number of brands without losing market share,” he cautions. “On paper, you may see that a brand makes up just 1% of the market, but you cannot simply substitute it with a similar model. People may be loyal to certain brands. Even if they can get something similar from the same group they will not necessarily switch.”

So far, management have given no indication of which brands might be under consideration for wind down, but there has been clarity into the composition of the new board. Jefferies notes “a preponderance of independent directors from outside the auto industry, few members from predecessor boards and a strong lead independent, all of which bodes well for governance.” The relatively slim and independent board includes representatives from such companies as Microsoft, Nestle and Astra Zeneca. Only two current executives, both previously announced as a part of the initial 2018 agreement, will serve on the board: FCA Chairman John Elkann and PSA Chief Executive Carlos Tavares. Andrea Agnelli, a current member of the FCA board, will also serve on the Stellantis board.

> “We remain supportive of Stellantis as a blueprint for legacy OEMs to remain relevant in an industry undergoing fundamental transformation

Solid corporate governance will serve as another core strength for the new company as it navigates the increasingly turbulent waters of the mobility landscape. For now, the general mood from the investment community and industry analysts is one of optimism and high expectations. “All eyes will be on the new entity exhibiting agility in product development and service-based mobility,” suggests Madhavan. Jefferies analysts point to the “above industry-average operating and capital-allocation skills” at both PSA and FCA as they conclude: “We remain supportive of Stellantis as a blueprint for legacy OEMs to remain relevant in an industry undergoing fundamental transformation.”

A fresh Spin on mobility: stakes rise in Ford's scooter gamble

Spin's Head of Europe speaks to Megan Lampinen about the micromobility outlook

© Spin

The number of mobility options on offer is growing rapidly, and multi-modal journeys are becoming increasingly popular in urban areas. For the incumbent vehicle manufacturers, establishing a foothold in the booming micromobility segment has become a pivotal means of remaining relevant. At Ford, that strategy is playing out in the form of Spin, the dockless electric scooter sharing company it acquired in 2018. Based in San Francisco, Spin has established a solid presence across the US market, and more recently began looking to Europe.

"2020 was a challenging and exciting year for Spin," explains Felix Petersen, Head of Europe. "We continued our expansion in the US very successfully throughout COVID, which was a key differentiator for us there. We didn't hesitate to continue operations during the original lockdown in the spring." In fact, some US cities, including Detroit and San Francisco, explicitly asked it remain in operation, as scooters offered a popular and relatively safe transport alternative at a time when buses and trains were under strain.

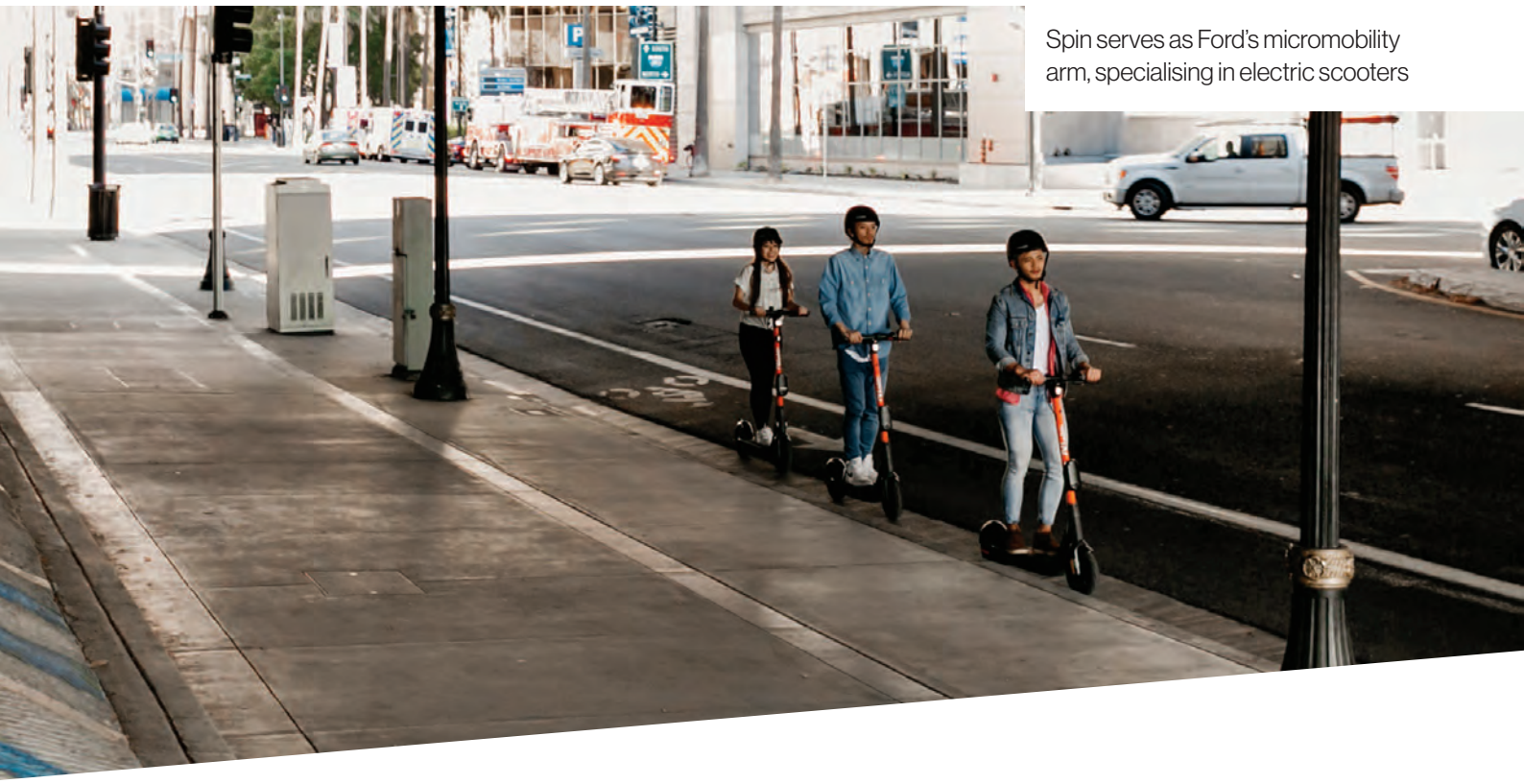
At the same time, Spin was busy expanding into Europe, starting with Germany. While the COVID-19 outbreak and lockdowns overshadowed the initial launch, it is now present there in 12 markets. Last year also saw pilots started in the UK; although private e-scooters are technically illegal on public roads in the UK, the Department for Transport is running a number trials in which users over the age of 18 with a valid driving licence can legally hire one. Operations are currently on track to begin in Spain in the first quarter of 2021.

"You cannot serve cities against their will"

When it comes to new launches, the micromobility segment hasn't always played by the rules. Some schemes have entered a region and begun offering services without a clear go ahead from local authorities. "This Wild West phase earned a lot of venture capital and was very driven on creating funding and blowing up revenue numbers quickly," Petersen tells *Automotive World*. "We kind of skipped that phase in Europe."

Europe itself represents a more fragmented market than the US, but many of the transport agencies and cities in the region are taking an active leadership role in the micromobility movement. That, combined with Spin's 'partnership promise' approach to entering new regions, has worked out well. From the start of operations Spin has pledged to obtain permission from cities and relevant transit authorities before launching in any new market.

"You cannot serve cities against their will," says Petersen. "The way things are working out in Europe, with a clear path to regulation, is very much in line with our approach. It has become clear that you cannot run any public-private partnership in a vacuum, especially where a service is provided to citizens."



Spin serves as Ford's micromobility arm, specialising in electric scooters

Strong partnerships with cities are also important to foster innovation. In most markets, scooters represent a whole new class of vehicle, and there is still much to learn. There are plenty of unanswered questions around why and how people are using them, as well as what modes of transport they are moving away from. Data sharing and funding research are helping to provide deeper understandings around this new mode of transport. "There are still many aspects we need to understand together with the cities; it is important not to see them as an antagonist to outsmart," he points out. "That's just not sustainable."

Innovation

The depth of R&D and innovation that goes into some of these schemes is starting to become more apparent. For instance, Spin Insights, an AI-driven computer vision component, has been added to the fleet to gain insights on user behaviour. The latest version incorporates Drover AI's PathPilot technology to help the scooter understand its surroundings in real time and assist riders in making safer decisions. Drawing on sensors in the scooter, an onboard camera and a machine learning platform, it can determine when the user is illegally riding on the sidewalk or parking improperly and issues an audio warning. Until now, this sort of detection had to be done manually or with photos from the user proving they parked correctly.

"Since all the vehicles are connected, it's incredible how quickly we can derive learnings from this and share them with the city," Peterson says. "If we see that sidewalk riding appears in a particular area, that could indicate that a micromobility lane may be needed there. Similarly, where parking compliance is low it suggests more scooter parking spaces are needed. This is a dream for any urban planner but it also shows that we are heavily investing into much more sophisticated technology."

Infrastructure

It also highlights the need for supporting infrastructure. Roads were not designed for micromobility, and that's starting to show. Some cities are actively exploring and investing in specific lanes or extended bike lanes to safely accommodate these schemes. "We need protected and prioritised lanes for all sorts of micromobility. This covers not just bikes and scooters; in the future it could include two- or three-wheeled pods, something that's a cross between a microcar and a bike, and everything in between."

Securing that physical road space can be tricky, particularly in crowded urban centres. And for politicians, taking away road space from cars isn't necessarily a popular move. "It's a question of how space is best distributed in cities," he observes. Space comes with a huge premium, but it could prove essential to the long-term success of micromobility schemes.

"It's a case of build the infrastructure and then it will come," insists Petersen. Lisbon offers a good case study. Five years ago the city started putting in bike lanes and quickly established more than 200km of dedicated lanes. "Lisbon wasn't really a bike city but with every kilometre of bike lane added you started seeing more and more bikes and usage," he adds. He also points to the

Micromobility success will hinge on supporting infrastructure, like dedicated lanes

Netherlands and Denmark as leading countries that have invested in supporting infrastructure. In some of these regions, cities are claiming that around 40% of all trips are done on bikes.

"We have reached a tipping point where people can see how these schemes bring an improvement in their quality of life rather than something that takes away liberty from them," he says. "At the same time, there's a generational shift with Generation Z and Millennials not being so keen on personal car ownership any more. That, coming together with some strong visions from the city, has put us at a point where this is accelerating quickly."

Building on a strong foundation

Spin is a fully owned subsidiary of Ford, and as part of that family it sits aside other mobility offerings such as GoRide and, in the past, Chariot. While Chariot is proof that not all of Ford's alternative mobility endeavours are successful, the power and backing of the Ford brand gives all of them a solid foundation from which to build.

"Cities value the stability of having a partner that is not driven by venture capital," Petersen explains. "It also gives them a partnership that is not so volatile as others might be, and a sense of being able to plan with greater certainty. We've seen companies enter cities and then leave and later enter them again. That makes it hard to plan.

Spin is incorporating Drover AI's PathPilot technology into the next generation Spin Insight e-scooter monitoring platform

When it comes to things like financial stability, compliance, environmental responsibility and supply chain, Ford is a strong brand that induces trust."

Petersen is keen to emphasise that Spin is not run as any sort of research project or innovation lab; it is its own business with a clear focus on profitability. Becoming profitable is one of the main goals for the wider mobility as a service industry, and Petersen insists Spin is on "a good path" towards that. To reach this target it intends to grow in the markets where it already plays, boosting rider numbers, as well as expanding its geographical reach in European cities. Moving beyond the urban environment is another key focus area. "Next steps including trying to understand how we can serve users more equitably in big cities and how we can enter into smaller and even rural communities," he says. "Micromobility can play a big role in rural areas, where they are sometimes gaps in public transport or first- and last-mile options."

From a broad perspective, Petersen regards Spin as a "core component" of the Ford Mobility strategy. The stated aim of Ford Mobility is to use technology, innovation and collaboration to improve the way people and goods move. The encompasses an ever-expanding range of partners and technologies, including electric scooters. "Ford democratised cars 100 years ago and it now aims to understand mobility for the 21st century. Spin is an important part of that," he confirms.

An inside look at Mazda's connectivity strategy

Mazda speaks to Megan Lampinen about how connectivity fits into the wider brand strategy for the European market

The demand for connected vehicle technologies continues to grow as new convenience and safety applications emerge. Europe has the second largest market share of connected cars in the world, going by 2019 data from Future Market Insights. The segment is expected to record a CAGR of about 16.9% between 2020 and 2025. For automakers, the right connectivity programme could prove a real market differentiator among consumers as well as a lucrative revenue stream.

Connecting car and driver

Mazda is a relative newcomer to the connected services realm. It has offered a consumer-facing app since 2012, but this was primarily limited to service and the relationship between the dealer and the customer. That's starting to change. In September this year its connected vehicle offensive reached Europe with the launch of the all-electric Mazda MX-30, which debuted a range of connected car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> These positive surprises are more important for me than the pain points that I thought Iwas going to have
>
> *Martijn ten Brink*
> *Mazda Motor Europe*

features via the MyMazda app. These include remote adjustment of the temperature and automatic climate control system as well as support with charging, such as locating and navigating to a charging station and controlling charging time.

"This app takes us into totally different territory, though we were able to build on what we already knew before with the app," explains Remo Palica, Manager for Connectivity at Mazda Motor Europe. "Here we see daily interactions for connected services, and suddenly that puts us in contact with a very different target audience."

Mazda, as a brand, has long followed the principle of 'Jinba Ittai', a Japanese term referring to the connection between the car and the driver. It will build on that for its connected services strategy, focussing on offerings that make life easier, that make the driver feel more in sync with the vehicle, and providing the right services at the right time.

"We are still in the start-up phase," emphasises Martjin ten Brink, Vice President, Sales and Customer Service at Mazda Motor Europe. "It has been a super interesting journey, not only preparing for launch but also seeing how customers interact with our vehicles and make use of connected services. As we learn what it does for us now, we're also seeing more potential in the future."

Pain points and unexpected surprises

It's no coincidence that Mazda's connectivity offensive in Europe kicked off with an electric vehicle. Charging and range anxiety are some of the pain points that connected technology can help tackle. "The amount of information that's available to customers with regards to charging

is incredible, and it's growing on a daily basis," ten Brink tells *Automotive World*. The technology not only helps with tracking down public chargers but also facilitates the best prices when charging at home, helping customers tap into times that offer the lowest tariffs.

Another real benefit for customers, particularly in Europe at the moment, is the ability to remotely active the vehicle's heating system. Cold, frosty mornings are the norm at this time of year in the region, and taking the chill off the cabin a few minutes before heading out can make the journey much more comfortable.

" I didn't even realise some of these were pain points until I found out I could solve it with connectivity," points out ten Brink. "These positive surprises are more important for me than the pain points that I thought I was going to have."

The challenge for automakers is to anticipate these use cases. "Customers may not see certain situations as a pain point because they have become used to them," points out Palica. Breakdown assistance and fuelling, he suggests, are just some of the areas ripe for improvement around customer experience, though the customer

may not realise it yet. "When you ask people what they want, you probably won't get the most valid response," he suggests. "With such a traditional industry, they normally expect what they have already." The famous quote usually attributed to Henry Ford sums up the situation with the observation: "If I had asked people what they wanted, they would have said faster horses."

Turning to tech giants

The smartphone mirroring of Apple CarPlay and Android Auto has proven popular with customers, who appreciate the familiarity and ease of use they bring. However, there's a limit to the benefits of this strategy for automakers. These are standard interfaces, and in relying on them automakers risk losing out on opportunities for brand differentiation. "Some of the features and equipment that we've put a lot of effort into developing get lost," notes ten Brink. "Because it's a standard interface, it only displays what these companies have decided needs to be displayed to the user. Their interest, though, doesn't necessarily match up with that of the automaker."

The advanced HUD reflection on the windscreen, which shows the navigation, vehicle speed and potential warnings, is a case in point. "These are not utilised to their fullest extent today by Android Auto. While we come traditionally come from the angle of how to make it most convenient and easy to use in a less distractive way, that is maybe not the expertise or focus of these players," adds Palica.

In the future, Mazda will look to harness the specific areas of expertise of certain tech players but not necessarily hand over full control. For instance, Palica concedes that it will not be able to compete with the data richness of the services from such big tech companies. On the other hand, Mazda does have 100 years of automotive safety expertise from which to draw, and it is well versed in addressing distracted driving concerns. "That's still something where we can complement each other," he adds. "We need to find the right partners on this journey, rather than doing everything ourselves."

Up next

While it's very early days for Mazda's connected efforts, the outlook is bullish. Ten Brink is "extremely happy" with the number of drivers that have enrolled. Making the registration procedure as easy as possible was a key focus–he claims a reasonable download speed can make this possible in two minutes. Mazda made the deliberate move to sacrifice some of the data it wanted in order to simplify the process. Has it resulted in happier users? "It's really too early for customer feedback and we only have one car line in there at the moment, but the biggest measurement is the number of people that sign up for the services and use them," notes Palica. "That's a very important starting point."

Mazda will follow this up by rolling out connectivity across its European line-up, starting next with the CX-5 SUV. It will also look to expand its technological capabilities and features. Mazda's Co-Pilot, its in-house version of autonomous driving, is slated to become standard tech on all of its models by 2025. If the driver for some reason becomes incapacitated, the technology can take control of the vehicle and drive it to a safe location, alerting emergency services.

As with all connected applications, Mazda's strategy will be governed by the customer's preferences and requirements. For a brand that has long focussed on the 'joy of driving', taking away the driving task may not go down well with owners. "We don't want, in any Mazda, for systems to take over the vehicle and be the driver," clarifies ten Brink. "We want Co-Pilot to help us in those instances that we need it, which essentially means that you would need all the features and functionalities of autonomous drive. However, we'll deploy it in a slightly different way."

> "When you ask people what they want, you probably won't get the most valid response. With such a traditional industry, they normally expect what they have already

The next few years could see a steep learning curve for this automaker. Palica doesn't underestimate the changes that are in store: "What we've learned so far is that there is still a lot for us to learn. We are figuring out how can we be a part of this innovation. For now, the focus is on opening our mind and offering services which work in the customer's favour."

QuantumScape CEO readies for solid-state battery ramp up

With a tentative timeline for deployment by 2025, all hands are on deck to get the first factory up and running. By Freddie Holmes

With every year that goes by, the electric vehicle (EV) sector has found it harder to make cars go further, charge faster and better retain capacity. Much of the challenge relates to the incumbent lithium-ion battery technology being used by all automakers today.

The hope has long been that solid-state cells, which do away with liquid electrolytes and reduce other challenges associated with lithium-ion chemistries, are the answer. By all accounts, solid-state batteries are the EV industry's Holy Grail.

Many have tried to tackle the problem, with limited success in some small-scale applications such as consumer wearables and small medical devices. But industrialising the kind of solid-state batteries needed for the harsh environment of road transportation is a monumental task. Doing so in high volumes and with flawless quality is even harder.

New York-headquartered QuantumScape has been investigating the issue since 2010, but is yet to make a commercial breakthrough: significant advances have been made in the laboratory, but the technology has not found its way into a production vehicle thus far. In a recent webcast held in December, founder and Chief Executive Jagdeep Singh suggested that the vision is becoming closer to a reality. Several scientists, most of whom have worked with QuantumScape in some way, were on hand to back Singh up during the event.

Data produced through customer tests warranted reactions such as "remarkable" and "game changing", not to mention the view of Stan Whittingham, co-inventor of the lithium-ion battery. "I haven't seen data this good anywhere else," he said in relation to the performance of QuantumScape's solid-state cells. The tests in question indicated that the single layer pouch cell, in

> "We feel like we have a multi-year window of time to bring this to market without muchcompetitive distraction

> Had we not received the level of traction that we've seen with passenger cars, we might well have looked at a market like long-haul trucking
>
> *Jagdeep Singh*
> *QuantumScape*

combination with a ceramic solid-state separator, could support a fast charge of zero to 80% in just 15 minutes, along with better durability and improved cold-weather performance.

Speaking to *Automotive World*, Singh went into greater detail on QuantumScape's long-term goals for the EV sector, and how in 2021 the company will pivot from the technology innovation phase into the first steps of commercialisation.

How do you feel the company is positioned heading into 2021?

While the pandemic has had an unprecedented impact on the world, 2020 was a pretty amazing year at QuantumScape for several reasons. There are three main risks that a start-up faces: can you make the technology work? Do customers want what you've made? And do you have the funding to build the technology?

On the technology front, we have made remarkable progress. Customer tests have shown some really amazing results for some of the key metrics such as power, cycle life and so on. The fact that customers have validated our cells at automotive rates of power is a big de-risking of the technology.

On the customer side, VW has made a massive commitment where it is effectively planning to base its next-generation EV fleet on this technology, subject to the constraints of our production volumes. We obviously cannot produce enough batteries to meet all of its demand, but it looks like it will take whatever we can produce.

The final risk was around financing, and our initial public offering (IPO) in November reduces that risk substantially. We have ended up with a billion-dollar balance sheet, which is more than enough to get

Volkswagen plans to use solid-state batteries within the next five years or so (Pictured: Volkswagen ID.4)

into the first stages of production. What remains to be done is execution, and that's what we're going to focus on in 2021.

Could you elaborate on what you mean by 'execution'?

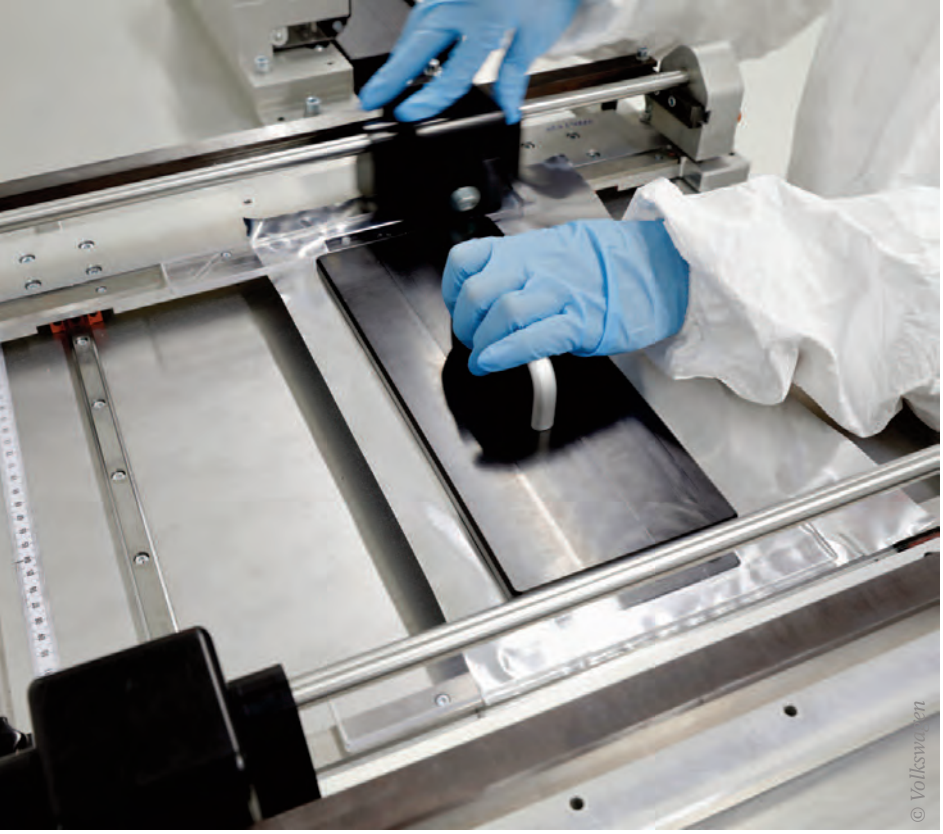
What that means from an engineering standpoint is the task of multi-layering these battery cells. Our single-layer pouch cells are about the size of a single playing card, and we plan on stacking them up into about 100 layers to make cells that are about the size of a deck of cards. That will be our main engineering task for 2021: to multi-layer these things.

In parallel, we plan to make progress toward starting the production process, from siting our facilities, ordering some of the large production tools that come with long lead times, and so on. If we accomplish those two elements, we're going to be in very good shape for 2021. We feel that the probability of getting solid-state technology into the market has never been higher.

Will we see dedicated QuantumScape factories or will you rely purely on Volkswagen facilities?

The first two factories are being built as a joint venture with VW, which is a 50/50 owned entity that will have joint branding. The output of those factories will go to VW. And remember that it is more than just one car company, it is a collection of brands including Porsche, Audi, Bentley and Lamborghini. Their needs will also be served by those two factories.

However, we're free to build other factories with other players or by ourselves. And for now, the business model is that we are in the factory building business, so we will make cells and sell cells, as opposed to licensing our technology out and letting somebody else manufacture it.



The Volkswagen Group includes more than just passenger car brands. Are there plans to produce solid-state batteries for heavy trucks as well?

The core technology we're building is applicable to a very broad set of applications. Within transportation, it fits well not only with passenger cars but also with trucking applications. The technology's viability goes even beyond that. It can serve consumer electronics and smartphones, and even the power grid: as renewables become a larger fraction of energy production, there's a greater need to store energy.

To be candid, we're very much focused on transportation, and particularly passenger cars for now. By 2025 there will be around three million electric cars being produced, and if we were to put QuantumScape cells into every one of those cars, that might equate to more than two billion cells. That's a lot of production, and north of US$20bn in revenue for us. Even if we build factories for most of the next decade, it'd be hard to get there, so I think we see no reason to get too distracted. Being focused has served us well so far and we want to solve one problem well before we take our eye off the ball.

Had we not received the level of traction that we've seen with passenger cars, we might well have looked at a market like long-haul trucking.

In your view, how big a challenge will it be to mass produce these solid-state cells for EVs?

I don't want to trivialise what it takes to ramp production to really high volumes; Tesla is testament to the fact that you can go through production hell when you try to ramp up production radically. But at the same time, there are no new laws of physics that need to be introduced for us to solve the problem, it's really a matter of having the capital that we need and getting people that understand mass production. Through our manufacturing joint venture with VW we will be able to leverage its expertise in high volume, high quality and high reliability manufacturing.

How would you summarise the key benefits of your technology?

You get much more energy per unit mass, which means much greater range. Our technology offers about 80% more energy density than the EVs to which we compared it. You get faster charging–almost a full charge in about 15 minutes–which could mean a lot for longer trips where charging might otherwise be more of an interruption. The technology is also safer and less expensive, and there is a clear cycle life benefit.

A big question many people have is how long the battery will last. With EVs today it is typically an eight-year warranty, at the end of which the battery will be at 60% to 70% capacity. One of the things we're really focused on is retaining much higher levels of capacity over time, north of 80% and into the 240,000 to 300,000-mile range. That is fundamental to the economics because you can amortise the battery investment over a much longer time, and it also improves the residual value of the vehicle.

We have multiple steps to go before getting this into a battery pack and actually integrating it in vehicles, but our technology brings a fundamental step change in that direction.

Why was QuantumScape taken public through a special purpose acquisition company (SPAC) as opposed to a conventional IPO?

SPACs have become incredibly popular, and to my understanding there are still around 140 SPACs out there that are looking to buy companies. We're going to see a lot more SPAC activity, but when there is that much activity in a sector, of course there will be bad deals along with the good ones. We saw this during the dot-com bubble of 2001: when you have that much capital chasing start-ups, some of that money will end up in companies that aren't necessarily ready or deserving of it.

Having said that, there will also be good companies that come out of this trend, and I believe the SPAC is a positive tool. The SPAC process is much more streamlined: we went from first contact with the SPAC to closing the deal three months later: all the SEC paperwork was completed and we were officially trading as QuantumScape. In addition, you can provide more direct guidance and give your financial statements to the investors, which is really helpful. My last company went public through a standard IPO, which took about a year and was pretty expensive.

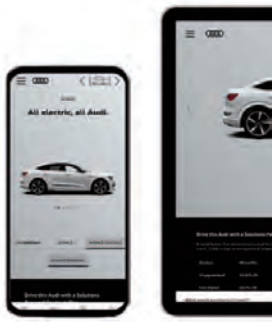
I think the SPAC is here to stay, but there will inevitably be abuses of the model where companies that have no business being public go public.

Does QuantumScape have any direct competitors at this stage?

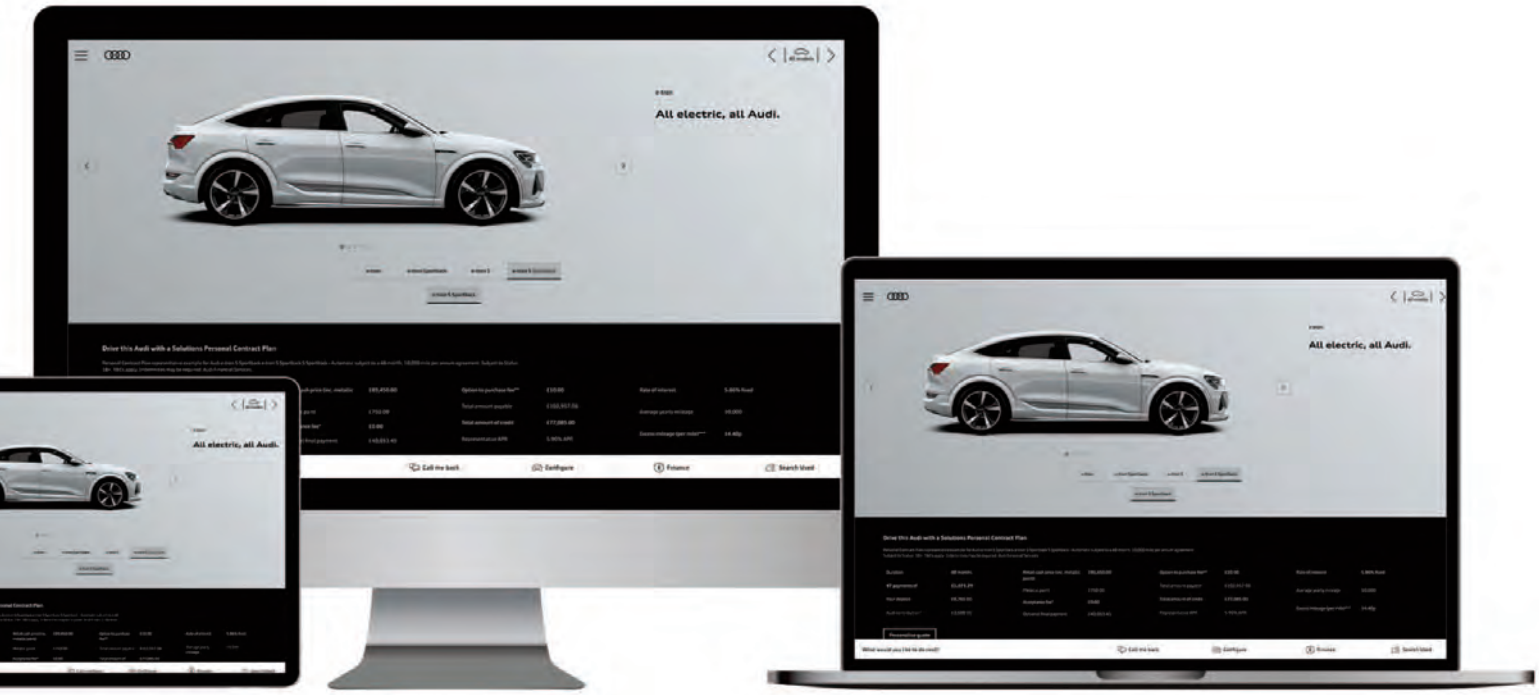
We are a vertically integrated battery company. We make both the battery and one of its key materials: the solid-state separator. The rest of the industry does not have that level of vertical integration. The LG Chems, the Panasonics, the CATLs of this world are just assemblers of cells, so if they want to compete with us and build a solid-state battery, they first have to find a supplier that can sell them a solid-state separator.

The problem is that their suppliers do not have one to offer, and we don't sell our separator. As such, the other battery companies are at the mercy of what the battery component sector is providing them. I don't want to sound like we're not taking the competition seriously, but we feel like we have a multi-year window of time to bring this to market without much competitive distraction.

Tectonic shifts ahead for automotive, with or without the pandemic



COVID-19 arrived at a time when the automotive industry was already undergoing fundamental change. These changes will only accelerate in the years to come. By Capgemini's Markus Winkler



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As in many sectors, COVID-19 had a significant impact on the automotive industry in 2020. Across the globe, factories closed, production declined, supply chains were severely affected, and demand decreased. It has been a tumultuous and transformative time of change.

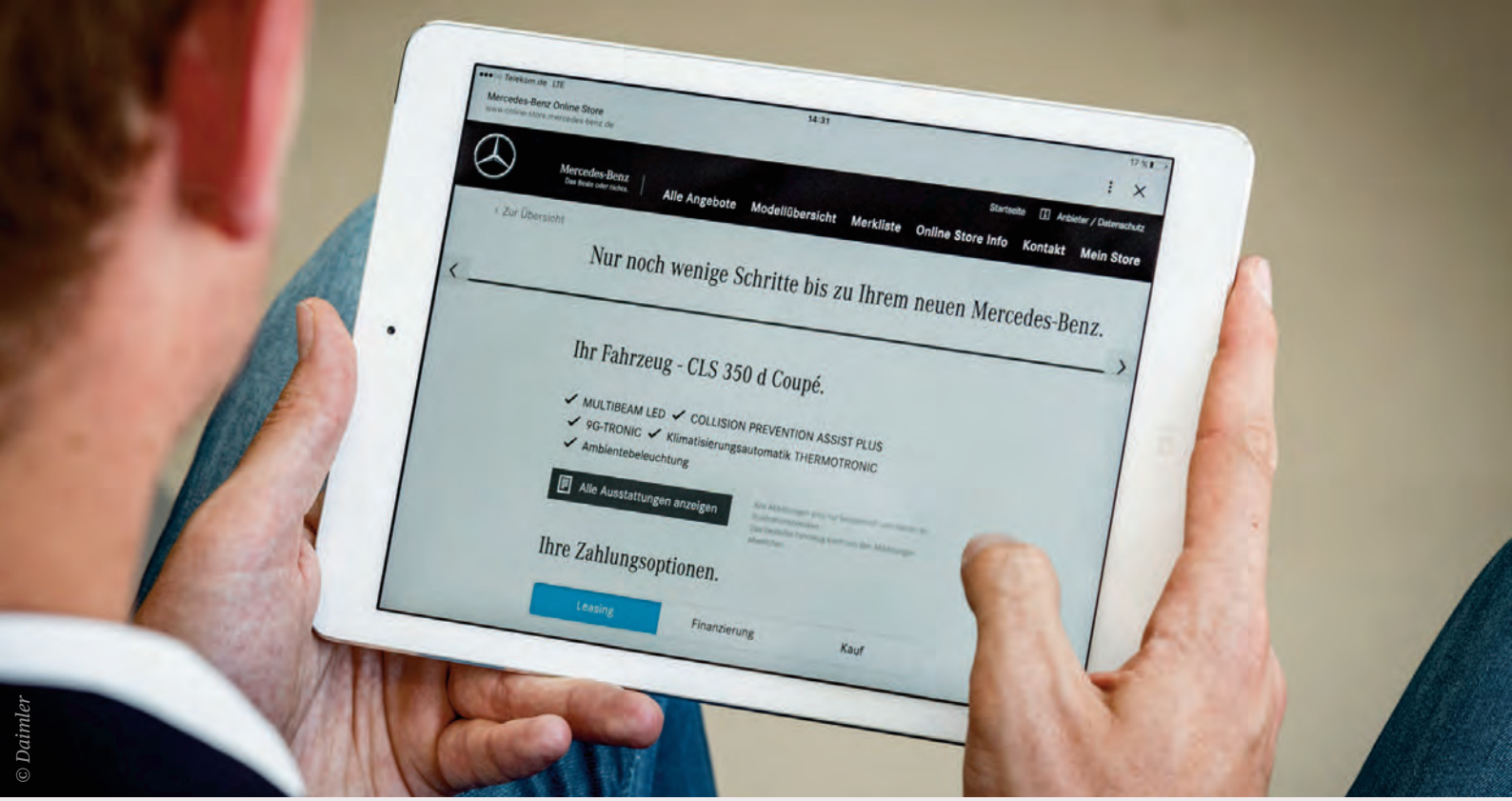
Beyond COVID-19 the automotive industry is experiencing tectonic shifts; consumer purchasing behaviour is changing and will only continue to evolve. Governments across the world are pressurising auto players to reduce CO2 emissions and adopt sustainable operational practices, forcing the sector to not only assess its ecological balance sheet but its social and ethical responsibilities as well.

Alongside this, technological innovation across the automotive industry accelerates. Electric vehicle (EV) adoption is increasing, and autonomous vehicle (AV) technology is improving. As the world grapples with and rebounds from COVID-19, industry, innovation, and business must continue. With this in mind, here are four key areas that will be crucial for the automotive industry in the coming year and beyond.

Ecological, social, and ethical responsibility will become more crucial

Across the world, the relationship between the environment, innovation and the use of technology is becoming increasingly critical. In the years to come, organisations will not just seek to deal with the challenges relating to electrification and decarbonising society, but the focus will centre on the entire responsibility balance sheet, including social and ethical responsibilities. This drive towards developing a truly responsible circular economy must remain at the forefront of the entire value chain.

Within the circular economy, digitisation creates the platform to support the delivery of sustainable mobility. However, digitisation cannot do this on its own. The wider automotive industry must embrace a cultural change and consider how it can, holistically, use technology to evolve the products and processes it provides the market. As it does, so it must take employees and customers along with it.



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Automakers and suppliers must reinvent themselves to become technology companies

Incumbent players must reinvent themselves using technology in order to stay competitive far down the line. Technologies such as artificial intelligence, cloud and IoT offer the potential and will be key to transforming successfully in 'intelligent industry', and meeting rising customer expectations.

For too long, automakers have assumed they can deliver services in much the same way as they deliver cars: doing most of the work themselves and only relying on suppliers to provide the parts. However, the tides are changing. Software is becoming an integral part of cars, and technology companies such as Google and Apple could be well-positioned to gain control of the customer interface, going after elements of the value chain. As a result, automakers risk losing the pole position when it comes to new technological know-how and connected services. Without reinvention, they risk missing out on revenue and, at worst, reversing their role and becoming the supplier.

Customer-centric and new sales models will continue to evolve

Across industries, consumers have become accustomed to customer-centric business models and convenient purchasing processes. In the automotive industry, there is an increasing demand for an upgraded, convenient online-offline sales journey that matches buying expectations and service standards in other industries. Three-quarters of consumers now want to buy their next car online. Experience is important too: around 86% of consumers are willing to share data with agents or automakers to experience a personalized, seamless journey[1].

New entrants like Polestar or Tesla have already successfully implemented agency or direct sales models in specific markets. This trend is especially true in the business-to-consumer (B2C) sector where traditional automakers are under pressure to provide their customers with comparable cross-industry experiences.

Even though COVID-19 poses several challenges for the automotive industry, it has also acted as a catalyst, accelerating the digitalisation of automotive sales. Compared with other industries, automakers have

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It is important to think not just in terms of pure product or service integration, but also the development of new capabilities. Businesses must examine how they can transition from being solely hardware providers towards becoming software-centric companies

historically been slow to use their channels to sell cars online, generate and own consumer data, and create value along the sales process. Many automakers have now started to transform their sales models. The agency sales model is promising as it presents a way of providing superior customer experience while using existing dealer assets and creating financial benefits on all sides.

The agency sales model assures dealers that they will retain a central position within the sales process and provides consumers with a seamless omni-channel experience. Price transparency and consistency is more prominent. Intra-brand price competition between dealers (agents) can be reduced and consumers' attraction through third-party offers can be lowered. Consumers and dealers both have much to gain from this model.

Strategic partnerships and intelligent industry are key

Automakers and suppliers must work simultaneously to form the right partnerships in order to buy or co-develop their vehicles, components, and solutions. Such partnerships can be accomplished at various levels.

It is important to think not just in terms of pure product or service integration, but also the development of new capabilities. Businesses must examine how they can transition from being solely hardware providers towards becoming software-centric companies. Namely, this requires significant changes in mindset, along with the development of software and analytics competencies and accompanying skillsets. To navigate these cultural and capability changes, it may make sense to join forces with companies that are experienced in data, cloud and the creation of AI-based insights that are the right fit to meet these changing needs.

Furthermore, companies must now focus on how to digitise key parts of their businesses and use embedded software, data, and new generation wireless connectivity to rethink what they do and how they do it. Powered by data, and the rapid development of emerging technologies like 5G, edge computing, AI and IoT, the automotive industry is transforming itself-and can truly embark on its journey towards becoming an intelligent industry.

[1] Agency Sales Model - Accelerating the future of automotive sales

Markus Winkler is Head of Global Automotive Sector at Capgemini

GM's BrightDrop: a sideline or a lifeline?

General Motors' new delivery business could revolutionise logistics and forge a potential evolutionary path for traditional automakers, writes Megan Lampinen

CES has evolved through the years and today represents much more than just consumer electronic devices. While a large portion of the show's exhibitors are now focussed on the mobility sector, General Motors pushed the boundaries even further with a jump into commercial tech with the announcement of its new BrightDrop business. Highlighted by Chief Executive Mary Bara in her keynote address, this new business area represents not just a possible revolution in first- and last-mile delivery but also a potential evolutionary path for traditional automakers in light of new consumer consumption patterns.

"Delivery companies manage thousands of vehicles and they are on the front lines of efforts to reduce emissions and congestion."

They are also experiencing a boom in demand, fuelled by e-commerce in the wake of COVID-19. Consumers are currently spending more on goods as opposed to services, which are generally unavailable or in short-supply due to virus-related restrictions on movement. Most of those goods are now being ordered online and need to be delivered. "The delivery sector became a lifeline to goods and services we couldn't access in person during COVID," observed Barra.

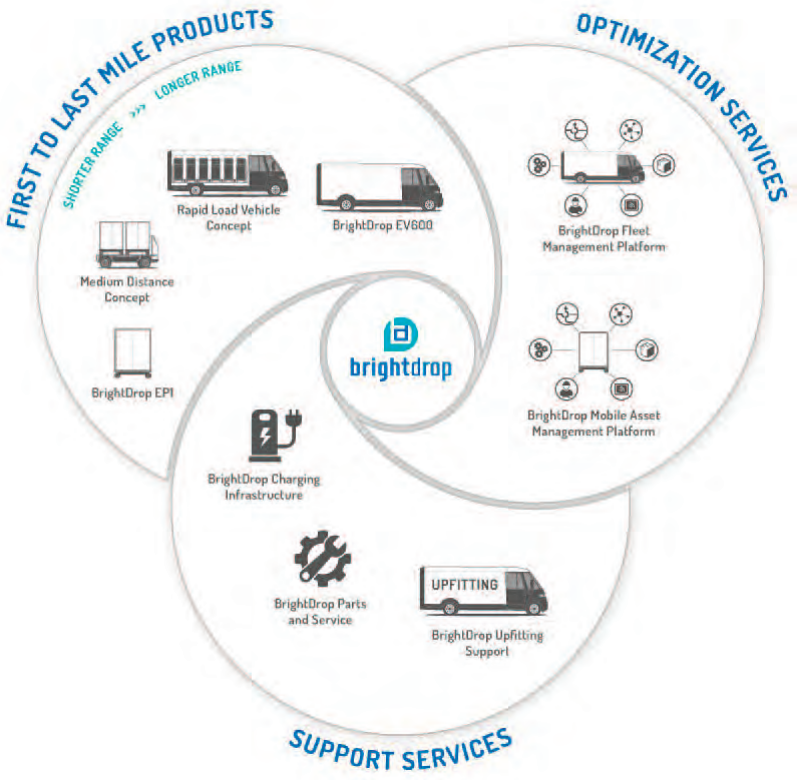
A one-stop ecosystem

BrightDrop is more than just a family of products and services, it's an ecosystem. Barra described it as "a one-stop solution for commercial customers to move goods in a better, more sustainable way." The promises are numerous: BrightDrop solutions can help businesses cut costs, maximise productivity, improve employee safety and freight security, and support overall sustainability efforts. "We are using the transition to an all-electric future to re-imagine how we move, but this is also an opportunity to re-imagine how goods are moved," Barra told CES attendees.

FedEx expects US residential deliveries to reach 100 million packages a day by 2023, three years earlier than previously estimated. "The need for reliable, sustainable transport never been higher," a FedEx spokesman commented.

First arrivals

The first BrightDrop product to market will be the EP1, a pallet powered by electric hub motors that is designed to move goods over short distances such as from the van to a customer's door. Speeds are slow, with a max of 3mph, but then it is



only intended to move alongside a delivery driver as he walks. The aim is to reduce the physical strain on drivers as well as package touch points and costs. The EP1 connects to the BrightDrop global asset management platform, allowing monitoring of its location and battery status, remote locking and unlocking and over-the-air updates of connected features.

FedEx ran a successful pilot with the EP1, which allowed the courier to handle 25% more packages a day on average. It plans to run another pilot in a major US city centre at some point in the first quarter this year. The pallet is scheduled to make its official market launch later in 2021.

Up next is the EV600 electric commercial vehicle, powered by GM's Ultium battery system which will also be used for passenger cars. The EV600 is targeted at goods delivery (600 cubic feet of cargo area) over long ranges (250 miles on a full charge). In a pinch, drivers can grab up to 170 miles of range with an hour of fast-charging using a 120kW DC charger. FedEx Express is also slated to be the first customer of the EV600 and should receive its first vehicles later this year. GM is also exploring an additional concept vehicle optimised for medium-duty distances.

Beyond hardware

Along with these products the new business offers an integrated, cloud-based software platform, which provides visibility and access to

EP1 connectivity provides customers real-time features, including location monitoring, battery status, remote commands to lock and unlock, and over-the-air updates of connected features

BrightDrop products through web and mobile interfaces. “Physical vehicles are fast becoming just one part of an ecosystem puzzle that can be adapted for profit,” said Rainer Mehl, Executive Vice President, Global Automotive, at Capgemini. He pointed specifically to the findings of a recent Capgemini report, which suggested “that automotive players are increasingly leveraging software and connected services to tap into different segments of the customer’s journey in and around a vehicle–for instance, harnessing data to drive new sources of revenue.”

The built-in connectivity in the EV600 allows fleet operators a host of options, including remote access to the vehicle’s location, battery and charging management, driver safety coaching, remote diagnostics, predictive maintenance insights, and over-the-air updates. Fleet management services in general are poised to become a big part of GM’s ecosystem and support its goal of becoming a top EV manufacturers. But, Mehl cautioned that simply providing the core product will not be enough to remain competitive: “Only by extending the core portfolio with corresponding service solutions, such as highly in-demand fleet management solutions, either by developing it themselves or through partnerships, can long-term

The EP1 is a propulsion-assisted electric pallet developed to easily move goods over short distances

success be achieved. With BrightDrop, GM clearly demonstrates its own strong view on the relevance of the ecosystem."

GM's evolution

BrightDrop emerged from GM's Global Innovation organisation, which also produced OnStar Insurance, OnStar Guardian and GM Defense. Notably, plans were underway well before COVID began to strain the delivery sector. "Although it's an ambitious goal to launch its own commercial delivery platform, it's fortuitous timing for GM to do so considering the e-commerce boom that the industry has seen over the last ten months," observed Jessica Caldwell, Edmunds' Executive Director of Insights.

GM estimates that the US market for parcel, food delivery and reverse logistics will top US$840bn by 2025. The World Economic Forum forecasts a 78% jump in demand for urban last-mile delivery by 2030. With more delivery vehicles on the roads, the pressure is on to tackle emissions and efficiency.

The timing may have been fortuitous but at the same time, the new business marks the logical conclusion of GM's considerable experience in electrification, mobility applications, telematics and fleet management.

Among other things it marks an important expansion of the Ultium platform, into which GM poured considerable resources in terms of finance and manpower. It also builds on the automaker's long fleet history. "This is an extension of GM's fleet business and will be easy for the company to launch and scale," Alyssa Altman, transportation lead at Publicis Sapient, told *Automotive World*.

Caldwell expressed a similar view: "GM has a ton of expertise in the truck market so adding a commercial element to this isn't a big leap. The company is adjusting the lens on how it sees the future of mobility and transportation–particularly not just catering to individual transportation."

This adjustment in perspective could prove pivotal to its long-term survival in the rapidly evolving transportation sector. "GM saw the growing needs of delivery services and figured out how to capitalise on it in a way that makes sense for the company," she added. "The world is changing rapidly and the demand for delivery services took a big leap during a pandemic, a trend that doesn't seem likely to reverse, so getting into that business and growing beyond personal transportation is a way for GM to carve out a niche for itself in evolving consumption patterns."

FedEx Express will be the first customer of the new, integrated solution

Leading the charge

If it makes sense for one incumbent, it could make sense for some of the others. Mehl pointed out that "mainstream OEMs are already making the move towards offering platforms and ecosystems around their core products. A tangible one-stop solution, specifically for the delivery service market, is yet to be seen, but development trends in this direction from automakers with fleet and commercial vehicle core products have been observed in the market."

Altman believes GM could be the first of many to make this strategy move. "Additional automakers will be right behind it, partnering with delivery companies and retailers," she predicted. Caldwell agrees: "It's likely that other automakers join this space as the goods-on-demand delivery system doesn't seem to be going anywhere anytime soon and the opportunity to achieve economies of scale for electrification programmes is likely enticing."

BrightDrop will initially target the US and Canadian markets.

© Scania

Regulators gently steer truck sector toward electrification

Tighter emissions targets will mean more zero-emission trucks, although scope remains for diesel and gas engine optimisation. By Freddie Holmes

Medium- and heavy-duty trucks are firmly on the path to electrification, guided by regulations which are either being finalised or have already been released.

As can be expected, updated targets allow for incremental improvements in diesel and natural gas trucks, and additional emissions reduction technologies and monitoring devices will ensure they comply on the road and not just in the lab. But now more than ever, there is an overarching emphasis on deploying alternatives to the internal combustion engine.

The US

California is a world leader in zero-emissions road transport. It is taking a stand not only on fleet average emissions, but the sale of diesel and gas trucks as well.

New legislation introduced in June will force truck fleets to adopt zero emissions trucks in the coming years. The Advanced Clean Trucks (ACT) bill will apply to both medium- and heavy-duty vehicles from Class 2b to Class 8: by 2035, 55% of Class 2b to 3 truck sales must be zero-emission, and 75% for Class 4 to 8 straight truck sales. In August, the California Air Resources Board (CARB) also passed the Heavy-Duty Low NOx Omnibus Regulation, which as the name suggests will focus on the reduction of nitrogen oxides (NOx). From 2024, limits will be some 75% lower than current standards, and 90% lower in 2027. The rule will be fully phased in by 2031.

At a federal level, regulations seek to put cleaner diesel and gas trucks on US roads. The second phase of greenhouse gas (GHG) emissions standards is expected to improve the fuel efficiency of highway tractor-trailers from roughly 6mpg in 2010 to about 9.5mpg in 2027. In 2018, the Environmental Protection Agency (EPA) also announced it would update NOx standards for heavy trucks through the Cleaner Trucks Initiative, with a proposed rulemaking due in 2021.

In December, a new ruling passed that will tweak how heavy-duty engines and vehicles are tested. The aim, according to the EPA, is “to improve accuracy and reduce testing burden,” but it concedes that the action is ultimately “limited in scope and does not have significant economic or environmental impacts.” The amendments apply primarily to measuring CO2 emissions, but also to pollutants such as NOx. One update entails a new fuel mapping test procedure, for example, which aims to reduce the variability of emissions test results and, as a result, a reduction in lab-to-lab variability.

Fleets such as J.B. Hunt have been keen to test electric trucks within daily operations

© Freightliner

According to figures from the EPA, the transportation sector accounted for 28% of US greenhouse gas emissions in 2018, of which medium- and heavy-duty trucks accounted for 23%. The US is expected to re-join the Paris Climate Accord following the appointment of Joe Biden to the White House, which could spur further regulatory reform for the transportation sector.

Europe

Regulations in Europe are set to tighten, and will apply to a wider range of emissions than ever before. Europe is currently subject to the Euro VI standard, with the next iteration being Euro VII. A finalised regulation is yet to be formally issued.

"There is still nothing official, but the work being commissioned by the European Commission indicates that there are a few areas of focus," said Felipe Rodriguez, Heavy-Duty Vehicles Program Lead at the International Council on Clean Transportation (ICCT). These focus areas include more stringent emission limits and the addition of new pollutants to be measured. The regulation might also be simplified to be fuel and technology neutral; manufacturers would not be pushed toward a particular solution, but more a defined outcome based on a strategy of their choosing.

A particular focus will be on ensuring low emissions under all EU driving conditions over the vehicle's entire useful life. There is also expected to be an emphasis on achieving near zero emissions within cities. On both fronts, this will require on-board monitoring (OBM) systems, which will be able to directly monitor tailpipe emissions. "Euro VII is expected to apply tighter limits across an even wider range of real world driving conditions, moving away from the laboratory test focus of the past, to ensure robustness of emissions control technologies," observed David Bennet, Chief Engineer for Heavy Duty Propulsion Solutions at Ricardo.

Zero emissions alternatives will be needed for inner city operations in future

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That being said, some laboratory tests might also be updated in order to record the emissions of greenhouse gases such as ammonia, as well as smaller particulates–down from 23 nanometres to ten nanometres–which can be hard to measure precisely during road tests. "The expected inclusion of limits for greenhouse gases such as nitrous oxide and methane within Euro VII, in addition to the already regulated CO2 emissions, could be challenging for both diesel and natural gas powered vehicles," warned Bennet. The takeaway from all this is that regulations prioritise an optimisation of the internal combustion engine (ICE), but limits can only go so low before an electric fleet is the answer.

According to Ricardo forecasts, a revision to the current regulation in the form of Euro VIe is expected between 2022 and 2023; a further revision, Euro VIf, by 2025; and then the full introduction of Euro VII around 2028. In July, Klaus Hadl, Lead Engineer Exhaust Aftertreatment Development at AVL, said it is unlikely that Euro VII would come into force earlier than 2025. Delays related to COVID-19 "have not increased the speed of discussions," he added.

If the EU commits to similar NOx reductions as implemented in California–10% below Euro VI–Ricardo's Bennet anticipates a tough time for truckmakers ahead. "This will be extremely challenging for the truck industry to comply with," he said, "although possible with the use of new engine and aftertreatment technologies."

Broadly speaking, the industry has tools at its disposal to meet proposed limits, but implementation may not be straightforward. Bennet noted that technologies such as close-coupled aftertreatment, multiple-brick NOx reduction solutions, electrically heated catalysts and cylinder deactivation are being considered for diesel trucks. "All of these technologies are already being used within the passenger car industry," he explained, "but achieving the durability requirements for heavy-duty trucks will be a challenge."

> Regulations prioritise an optimisation of the internal combustion engine (ICE), but limits can only go so low before an electric fleet is the answer

Although the cost impacts of all these technologies will be substantial, he added, the European Commission is expected to perform a cost-benefit analysis before Euro VII is finalised. Discussions between industry stakeholders and the Commission have illustrated mounting friction.

Tension builds

While stakeholders appear to have a broad understanding of the key variables being considered, many are pushing for greater clarity on what exactly to expect with Euro VII.

An October 2020 meeting among members of the Advisory Group on Vehicle Emissions Standards (AGVES), which is chaired by a department within the European Commission, left many concerned about the strategy for Euro VII. A letter co-signed by leaders of several industry bodies, including automaker association ACEA, supplier association CLEPA and the International Road Transport Organisation (IRU), indicated as such. "Our concern is the direction in which the 27 October AGVES meeting was steered," it read. The content of any new regulation must be "data driven", the group argued, and not based on "broad statements."

In December, ACEA again urged the Commission to "clearly define the objectives" for potential Euro VII proposals. As part of a scathing review of discussions, ACEA wrote that the proposals presented in the AGVES meeting on 27 October were "technically infeasible for vehicles with combustion engines" and had "not been subject to any impact assessment or peer review." Analysis of one presentation slide, which focussed on road testing, concluded that unrealistic cold-start parameters would "practically delete [the] ICE as an option for heavy-duty vehicles."

The proposed road testing procedure, ACEA added, "basically aims to impose absolute emission controls under any possible driving event, however infrequent and at whatever cost." In essence, this would mean that vehicles would be designed as if they would only be driven in worst-case scenarios: "E.g. someone living in an isolated place at the top of a mountain, towing a trailer in winter conditions." Other terms used to describe the proposed regulation—"very costly", "massively complicated", and "significant uncertainty"—clearly illustrate ACEA's view. It added that the Commission "seems to have misunderstood" the concept of OBM systems.

If emissions targets were to force manufacturers to sell a minimum quota of zero emissions trucks, the industry would have to scramble to accelerate development timelines and infrastructure build-out. Consumers would also be thrust into the world of

electrification faster than expected, but this seems an unlikely outcome. The next AGVES meeting hosted by the European Commission will be held on 24 February 2021, where discussions will continue.

China

The China VI emissions standard is "among the world's most stringent" of its kind, according to the ICCT, but broadly mirrors Euro VI standards. China VI-b took effect for new natural gas-powered heavy trucks on 1 January 2021 and will come into effect for all new heavy trucks on 1 July 2023. It dictates a 70% lower limit for nitrogen oxides (NOX) and particulate matter (PM) emissions compared to the China V standard. In September, the Chinese government committed to achieving carbon neutrality before 2060.

In the world's largest electric vehicle market, an emphasis has been placed not only on adding electric models to the fleet. It is also looking to remove older, more heavily polluting commercial vehicles from the road. US-based commercial vehicle research group ACT Research says that the Chinese government is essentially forcing a refresh of the truck fleet, which includes many older models. "The commercial vehicle market in China is shifting in response to government policy," it said in December. "The single major market driver currently is the continued elimination of NSIII vehicles." Fitch Ratings is of a similar opinion, and expects the initiative to remove older trucks will keep truck sales above one million units annually for "the next two to three years." Regions such as Beijing, Tianjin and Hebei, had set a requirement for one million China-III emission-standard heavy- and medium-duty trucks to be scrapped by the end of 2020.

While scrappage schemes will inevitably reduce emissions from China's transportation sector, it may not necessarily accelerate the adoption of electric models across the medium- or heavy-duty sector. It is estimated that at least 400,000 electric trucks are in operation across China.

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A gradual transition

For most of the world's developed truck markets, the period to 2030 looks likely to turn the tide in favour of zero emissions alternatives to diesel and natural gas.

Work will continue to commercialise both battery electric and hydrogen fuel cell solutions, and although questions remain around total cost of ownership and durability, the pace of regulatory reform seems to have allowed time for a gradual transition.

Where could shared autonomous vehicles take us in 2021?

Near-term opportunities are emerging in rural areas and for logistics use cases. By Sigma Dolins, Birger Lofgren and Goran Smith

Starting in 2016, autonomous vehicles (AVs) began capturing the global imagination: Elon Musk announced that all new Teslas would eventually have the hardware needed to drive on their own, and Waymo launched its Early Rider programme in Chandler, Arizona shortly thereafter. Envisioning improved accessibility and lower costs, public transit agencies raced to explore how public transit systems might offer AVs the quickest path to full autonomy.

Yet despite the hype, these public pilots showed that the technology was still far away from the envisioned future due to several factors: technical limitations in 5G and sensor technologies, significant legal gaps, and safety hazards—which were made clear with the 2018 fatality of Elizabeth Herzberg in Tempe, Arizona.

With public opinion uncertain, and policy and technology lagging, 2019 indicated a shift in focus away from passenger transport towards logistics applications. Then came 2020; when it comes to transportation, COVID-19 has both hindered development and revealed new opportunities.

Is rural the new black for AVs in public transit?

Among other things, travel restrictions due to COVID-19 have forced many to work from home, a shift in business operations that some companies are prepared to continue for the foreseeable future. This has triggered a decrease in the value of commercial real estate and a rise in suburban residential prices, as well as a debate on whether people will be willing to live further away from job markets in the future. In other words, will rural living become more desirable post-COVID-19?

In parallel, the public sector is starting to look at piloting new mobility technologies outside the metropolitan regions. The motivation here is not for the viral, rapid adoption of users, but rather the potential savings; compared to their urban counterparts, sparsely

> “Much like electric cars first sparked range anxiety in unfamiliar consumers, shared AVs seem to engender sharing anxiety in potential users

Transporting goods may be an easier route to commercial automation than carrying passengers

© Enride

populated areas face higher costs in providing public transit. Consequently, the provision of public transport is often limited, which implies that new mobility services could have a substantial impact on quality of life for the residents in these towns that do not have access to private cars. Additionally, some of the challenges in large cities, such as complex traffic or buildings that interfere with sensors, are less of an issue in smaller towns.

To explore opportunities for shared AVs in rural contexts, RISE, a Swedish research institute, initiated the "Autonomous Countryside" project in 2020, with the goal of helping Swedish municipalities to understand if shared AVs can replace regular buses at some of their public transit routes with low ridership. The level of interest has been promising, but the road ahead is not without obstacles; rural use requires higher speeds over longer distances, compared to what current solutions offer. There is also less digital and physical infrastructure supporting navigation on the countryside, and the willingness to share rides is particularly low amongst habitual car drivers. Yet, enhanced AV concepts are on the way and the pandemic might revive the need for public transit in rural communities—an environment for shared AVs that could offer more gain for less risk.

Is autonomous technology headed for logistics next?

The willingness to share journeys was a complex subject even before COVID-19. In 2019, as part of the "Societal Readiness Index for Shared Autonomy" project, RISE and Keolis hosted focus groups on the topic in Australia. These showed a wide-ranging acceptance for contemporary on-demand services like UberPool or Keoride.

But even the most devout supporters of these services did not respond well to the idea of shared AVs. Why? Much like electric cars first sparked range anxiety in unfamiliar consumers, shared AVs seem to engender sharing anxiety in potential users. As one interviewee explained: "It is not so much the technology, I'm quite comfortable with that... [But] there is a certain level of trust placed in the bus driver, an expectation they would be there to help." Thus, in contrast to what previous research has indicated, his greatest fear was not about technological capabilities, but in sharing rides with strangers without the reassurance and authority of a driver figure.

COVID-19 takes sharing anxiety to even greater heights. As a result, 2021 will likely be a difficult year for shared AV trials except perhaps in communities where the infection is tightly controlled, like New Zealand or China. But as people have been less inclined to travel, the pandemic has caused a spike in the demand for home deliveries. According to a recent consumer survey by market research firm Euromonitor International, about 50% of consumers surveyed believe they will permanently change their shopping habits towards e-commerce, and a quarter plan to visit stores less frequently.

With existing hurdles facing AVs that carry human passengers, and the dire need for safe transportation of goods during the pandemic, logistics has become a stronger financial case for exploring AVs. COVID-19 has normalised home grocery deliveries, and autonomous trucking companies like TuSimple and Einride are developing means to keep up with consumer demand. Einride in particular is developing with RISE the safety cases of running at higher speeds in mixed traffic, relying only on remote safety surveillance in Gothenburg, Sweden. Interestingly, the vehicle even broke speed records at the renowned Top Gear test track.

Could rural, passenger and logistics applications be combined?

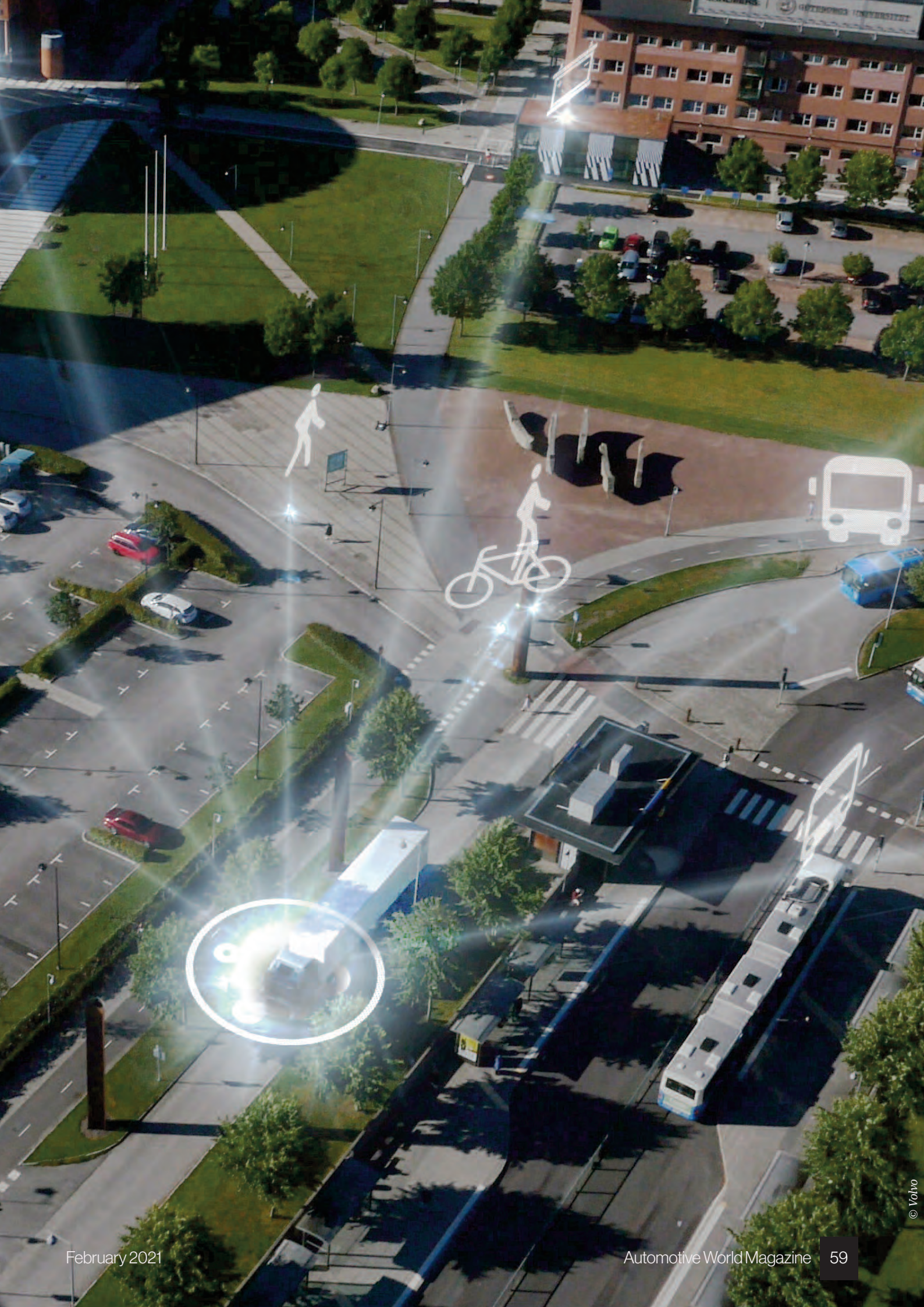
Even though COVID-19 may have slowed people down and sped up the need for goods deliveries, there will always be need for passenger transport. RISE, together with T-Engineering, Keolis, Berge, and Freelway, is working on "Voltron", a proof-of-concept shuttle that can carry both passengers and self-driving delivery robots. In theory, such a shuttle could reduce fleet operation costs for logistics companies by increasing the range of first- and last-mile robots, while vehicles operating for late-night service could extend public transit offerings.

Although much work needs to be done to understand where, when and how shared AVs can contribute to sustainable transport systems, the work being carried out by RISE and partners indicates that rural and logistics use cases might be worthy of exploration. Perhaps the silver lining to 2020 will be revealed through the development of autonomous, integrated logistics-and-passenger solutions for rural transport.

Sigma Dolins and Goran Smith are Senior Researchers at the RISE Research Institutes of Sweden, where Birger Lofgren is a Director

Truckmakers must define their role in connected service space

Automakers need to up their game in harnessing the potential of data-driven, connected services. By Megan Lampinen



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Connected and digital technology is rapidly rewriting the rules of the game for trucking. As trucks become smarter, both automakers and fleet operators are seeking to leverage valuable data to boost their bottom line. Automakers that move quickly to capitalise on this trend could secure their place in an increasingly competitive landscape, tapping new revenue streams around data monetisation and service provision. Those that do not could find themselves out of the game completely.

trucking customers really value these services. In Germany and the US, 50% of survey respondents said that these services increase the value of the truck. In China, that figure jumps to more than 80%.

"Connected services open up new revenue streams, and those revenue streams will be highly relevant for segment players in the future," says Philipp Haaf, Senior Manager, Automotive, and Head of eMobility Solutions at Capgemini Invent. The time to act, though, is now.

> "Connected trucks can generate up to 25GB of data per hour. In comparison, the average internet user processes around 1.5GB of data per day

Uptake and interest

Fleet managers, dispatchers and truck drivers around the world are showing growing interest in connected services. In China, 58% of these users already have connected services in their trucks. In the US that figure stands at 57%, while in Germany it is 44%. That's according to Capgemini's latest report, *Taking the lead with sustainable transportation*. Importantly, the study also found that

The CV sector has had a reputation for relative conservatism when it comes to technology adoption, but this is starting to change and developments are gaining pace. "In the passenger car industry, many innovations are driven by the change in drivetrain technology, particularly electrification. The trigger for that development is linked to CO2 regulations," he notes. "In the truck industry now, those strengthened CO2 regulations are also coming in, putting

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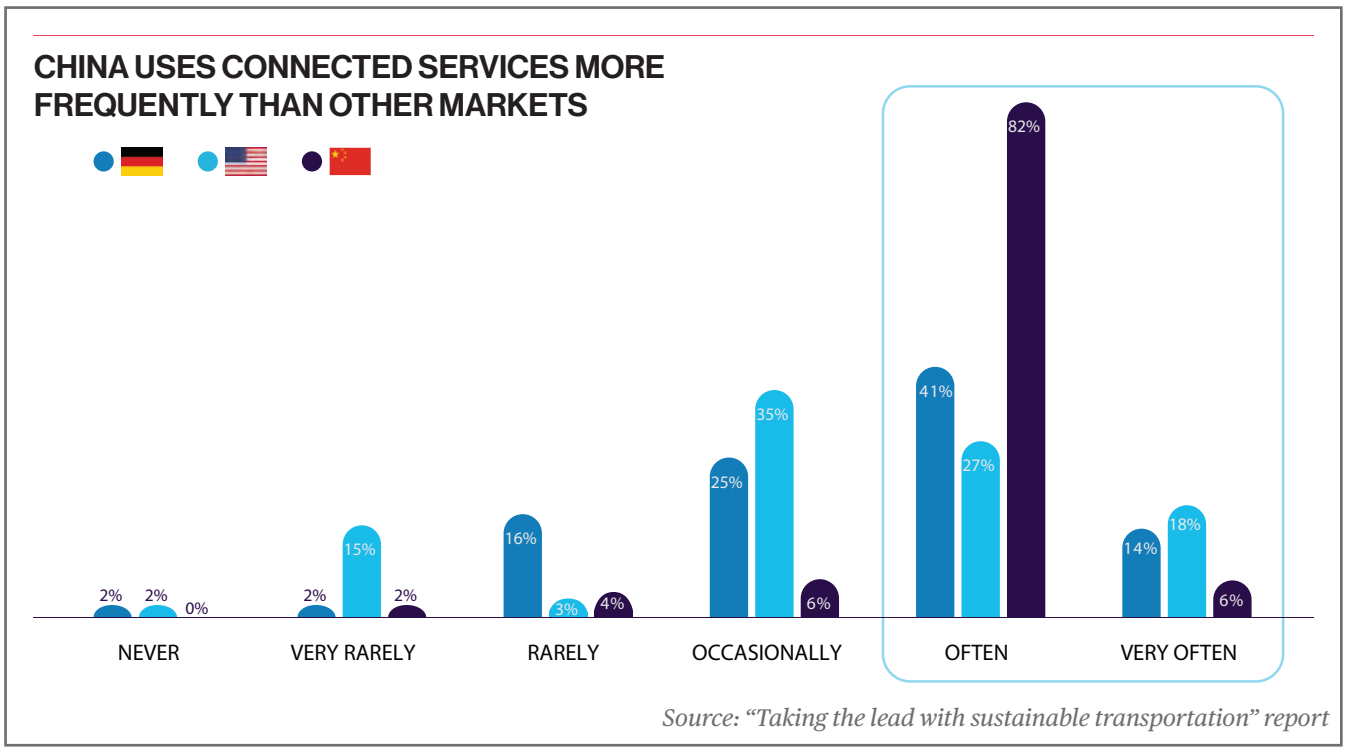
manufacturers under pressure to come up with new concepts."

The shift to electrification, in both cars and trucks, creates a greater need to connect the vehicles with their environment, such as to enable smarter routing and charging availability. Trucking, which is a low-margin B2B business, has an even greater need to provide smart solutions to push those new technologies.

Regional differences

Perceptions of connected services vary by geography, and automakers may need to adjust their go-to-market strategies accordingly. For instance, Capgemini found that Chinese customers are most willing to pay for efficiency services such as vehicle monitoring and fleet management. On the other hand, customers in Germany are most willing to pay for safety services. Those in the US are more likely to pay for services relating to driver convenience.

On the whole, though, the Chinese are both the most active users of connected services and the most willing to pay for them, and this trend extends beyond automotive. "In general, Chinese customers are more enthusiastic about new technology and, thus, digital and connected services," Haaf tells *Automotive World*. "The frequency of usage is much higher in their business life as well as in their private life than in other countries." Chinese regulators have also been encouraging the opening of public data to promote innovation, more so than their counterparts in Europe, for instance.



Source: "Taking the lead with sustainable transportation" report

In light of such varied customer preferences and willingness to pay, automakers may choose to offer digital services separately or in bundles. "We believe that automakers will offer packages of connected services, but they might differ depending on market and user-specific preferences," he adds. "However, this is something new for OEMs and they need to better understand in depth the market preferences."

> "The battle is on for tech companies as well as automotive OEMs. The question now is who will be the winner, or the one who is participating the most in those new revenue streams

Monetising the data

Getting it right could prove a very lucrative business. Connected vehicles generate vast amounts of data. In-vehicle technologies such as sensors, cameras and Wi-Fi displays connect the driver to the vehicle, to other vehicles and to the surrounding infrastructure. According to some estimates, connected trucks can generate up to 25GB of data per hour. In comparison, the average internet user processes around 1.5GB of data per day. Monetising all this data from the truck will become increasingly important.

The good news is that there are plenty of parties interested in buying that data. For instance, city municipalities might use it to find out more about traffic patterns. Insurance companies could use the data to inform their usage-based tariff analysis. Mapping and location-based companies would also be hungry for more data, as would weather stations. “Trucks are moving on the road all day. With their cameras it is pretty easy to track whether the sun is shining or if the road is wet,” says Haaf.

The demand is clearly there, but the jury is still out on whether it will be met by today’s truck manufacturers or someone else. “The battle is on for tech companies as well as automotive OEMs,” warns Haaf. “The question now is who will be the winner, or the one who is participating the most in those new revenue streams.” In the end, he expects the industry to consist of a mix of services provided by tech companies and automakers, with plenty of collaborations and partnerships thrown in.

Haaf likens the situation to that of smartphones: users do not expect every solution on an Apple device to be produced and provided by Apple: “It’s an ecosystem, and the attractiveness of the ecosystem is driven by its openness towards third parties to provide their solutions on that device.” For automakers, it’s decision time. “They need to determine what connected services need to be built–and run–by themselves in order to keep up to date with their data analytics competencies. They also need to figure out what solutions their customers may expect, but not necessarily expect the automakers to provide themselves.”

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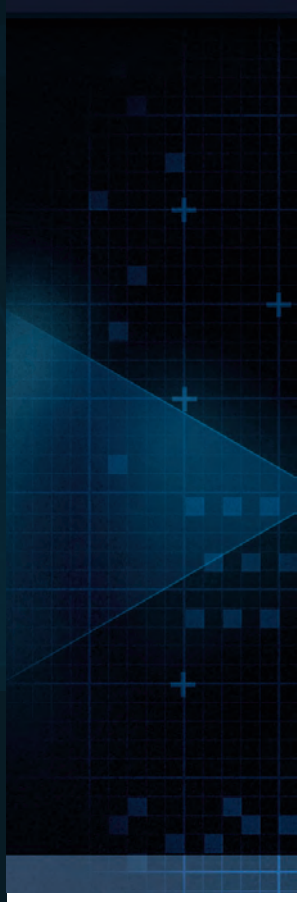
This last aspect makes a big difference: it is all about capabilities. “Companies must enable themselves to be flexible when it comes to requirements of the market and to scale those solutions globally, based on the given IT infrastructure and the capabilities of the truck. While the battle between the big tech companies and the automotive OEMs is still going on, in the near future, data-driven services and connected services will be key for truckmakers to stay relevant within their field of competitors.”



New LiDAR uses solar tech to boost AV vision

Sense Photonics says its game-changing approach to LiDAR should help autonomous vehicles see further and with better reliability. Freddie Holmes speaks to its CEO to find out more

LiDAR is seen by most as an important part of the autonomous vehicle (AV) sensor suite, and many start-ups have tapped into growing demand for sensors that can see further and with greater accuracy. Innovation has been swift, and bulky sensors of the early 2010s are making way for sleeker, high-performance units.

The sector is now awash with new technologies and there are already many different types of LiDAR available. One start-up has even developed a proprietary system that leans on success seen in the solar industry. Sense Photonics was founded in 2016, and has offices in the US, UK and Israel. It is currently an early-stage start-up that has gone through Series A funding, but has big ambitions to shake up the LiDAR sector.

In January 2021, the company announced it was the first to accurately detect objects from 200 metres using a particular type of sensor: a solid state, 940 nanometre (nm) wavelength, global shutter flash LiDAR. Global shutter is where an entire image is captured in one go, as opposed to a rolling shutter in which an image is captured in multiple frames. This ensures that the LiDAR's view is not distorted by things such as motion blur or vibrations while driving. Importantly, it is 'eye-safe'– the lasers will not damage human vision as they scan–and is geared specifically for mass market automotive applications. Early systems will be available in 2021 for customer evaluation ahead of a 2024 series production schedule.

The company's founders leveraged vertical-cavity surface-emitting laser (VCSEL) technology for this sensor. These VCSEL arrays, which simply emit light, have been used to track the sun's movements. It soon became clear that these arrays could also be used in other applications such as LiDAR. An off-the-shelf light detector

Sense illuminator

VCSEL array micro-transfer-printed on:

Flexible substrate

Rigid substrate

Sense Silicon

Backside illuminated high-res SPAD array

© Sense Photonics

VCSEL arrays have also been used in the solar industry

supplied by Infineon was originally used to underpin this sensor, but a proprietary replacement based on SPAD (single photon avalanche diode) technology was soon introduced. SPAD technology is also used by the LiDAR in the iPhone 12.

Shauna McIntyre joined Sense Photonics as Chief Executive in April 2020. An engineer by trade, McIntyre has a diverse background that ranges from developing emissions reduction systems at Honeywell Turbo to running the Google Automotive Services programme, where she worked with automakers like Volvo Cars to find applications for Google products. This understanding of complex mechanical systems and the fast-paced tech world has carried over nicely to the LiDAR space. Mechanical complexity could make a LiDAR less reliable, she explains, which is why Sense Photonics has pursued a solid-state sensor.

"Our thesis had always been that flash LiDAR was the answer. It is solid-state, and provides what AVs need in terms of robustness," McIntyre told *Automotive World*. "It is a very simplistic design, which is what's best for automotive given the potential for things to go wrong," she emphasised. A specific price could not be given, but the semiconductor required for Sense Photonics' LiDAR is "dirt cheap" compared to some other mechanical LiDARs, McIntyre noted, which should keep costs down.

"An important milestone"

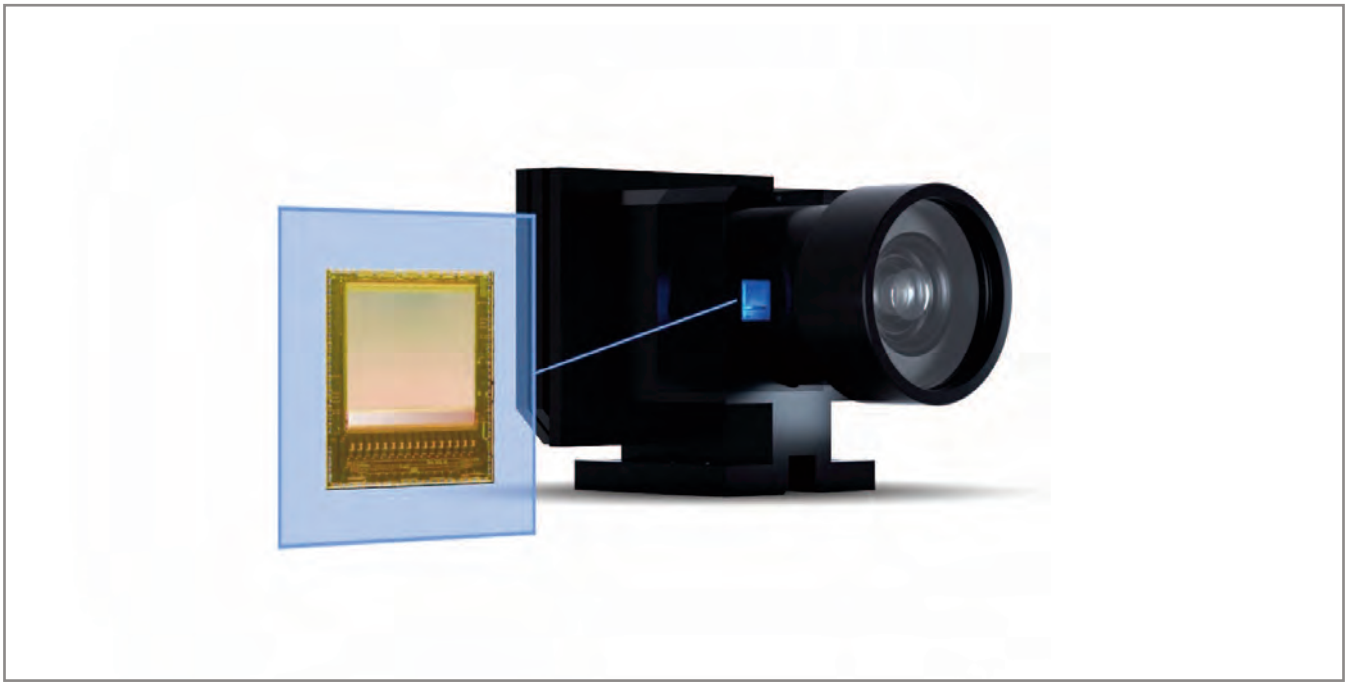
Unlike most other solid-state units, Sense Photonics' can recognise objects at long range. There is a common testing standard used across the industry to standardise how the range and accuracy of a LiDAR sensor is measured. An important element is

reflectivity, which is used to determine how far a LiDAR can accurately pick up objects. Light, smooth surfaces are generally more reflective (closer to 100% reflectivity) while dark, irregular surfaces are less reflective (closer to 0% reflectivity). A base standard of 10% reflectivity is used by all LiDAR makers to define their maximum range.

There are many different types of LiDAR sensors designed to cover different fields of view, at different ranges and with different architectures. Ranges also differ between solid-state systems and mechanical systems. Sense Photonics is not the first LiDAR company to crack the 200 metre range at 10% reflectivity. Velodyne's Alpha Prime mechanical LiDAR offers a 220 metre range at 10% reflectivity, while its Velabit solid-state LiDAR offers a maximum range of 100 metres. Other long-range LiDAR sensors are due to hit the market soon. Luminar's Iris LiDAR can detect objects and vehicles at a range of 250 metres at 10% reflectivity, and is due to enter series production in 2022 with Volvo Cars.

Where Sense Photonics differs is that its solid-state LiDAR has been able to meet the top end of industry standards. The availability of a solid-state LiDAR that offers 200 metre detection range is significant for an AV company, said McIntyre.

"It is an important milestone. When you have a vehicle travelling 100kph and can only see 0.2 kilometres ahead, that is the base requirement for any kind of highway autonomy," she explained. Even a range of 150 metres, she suggested, is probably "cutting it close." Sense Photonics is in discussion with various players in the AV space, and although no names can be released, McIntyre advised that much of the interest has come from traditional automakers and not just AV companies.



© Sense Photonics

As the LiDAR is solid-state, the expectation is that it will be less prone to mechanical wear and tear

LiDAR or NODAR

A small faction of the industry has lobbied against LiDAR use in AVs, the argument being that such systems might be over reliant on a particular set of data.

Tesla's views on the subject are well reported, and one start-up has even emerged under the name of 'NODAR' and aims to offer long-range 3D vision using cameras. Intel-owned Mobileye has long been a proponent of camera-based autonomous driving systems–dubbed video LiDAR or 'VIDAR'–although in December it revealed plans to begin producing its own LiDAR sensors as well. The vast majority of the industry is in favour of sensor fusion, combining camera, radar, infrared and LiDAR to create a rich set of data with built-in redundancy.

McIntyre agrees that it is not necessarily an 'either or' discussion and recalls a similar debate during her time at Ford. Powertrain engineers, she explained, were debating different approaches to emissions reduction: should it be directly after the engine, inside the engine itself or closer to the tailpipe, and what technology should be used? "We are experiencing a similar trend now with AV technology, just on steroids," McIntyre observed.

Challenges arise when it comes to a camera-centric platform, she added. "Cameras are two-dimensional, whereas LiDAR is three-dimensional. As such, those who do not believe in LiDAR are required to have an abundance of cameras to post-process and deduce what the third dimension is," she explained. "I think the 'no LiDAR' approach has ultimately arisen due to a lack of options when it comes to LiDAR."

It is also worth noting that not all AV developers have their heart set on solid-state LiDAR. Oliver Cameron, Chief Executive of Voyage, says mechanical LiDAR is perfectly useful for a robotaxi today. "The truth is I've never fully understood the distaste for

> "Maybe at one point there will be a 'Lamborghini of LiDAR' in the industry that offers space-age levels of range

Voyage CEO Oliver Cameron says mechanical LiDAR remains useful

© Voyage

mechanical LiDARs," said Cameron in September. "I'll preface this by saying that solid-state is of course 'better', but if you look inside any car today there are many mechanical, moving pieces which get validated for many years of service."

How much further can LiDAR go?

LiDAR is not only brought in to scout objects far in the distance. It is also used to spot objects close by and is particularly useful in dense urban areas where cars, pedestrians, cyclists, animals and many other moving objects are in close vicinity. Sense Photonics is pushing its long-range LiDAR, but the company also plans to commercialise medium- and short-range sensors. "The vehicle needs different ranges for different use cases; it doesn't only need 200 metres," explained McIntyre. "What's important is that as these objects get closer, the vehicle gets a better picture of its full surroundings."

LiDAR sensors that can accurately recognise objects from 250 metres or more could be on the horizon, too, although McIntyre concedes that this might need a new architecture. "If you're on an autobahn travelling at 200kph, is 200 metres enough? I'm not sure," she concluded. "Maybe at one point there will be a 'Lamborghini of LiDAR' in the industry that offers space-age levels of range. But in the near term, high-volume robotaxis will ultimately need a combination of performance and affordability."

COMMENT:

A national 'right to repair' push puts Big Data under scrutiny

Moshe Shlisel argues that the national push for right to repair measures could introduce critical safety issues

Amid mounting scrutiny into Big Data's role in the modern economy, the movement to provide citizens with more control over their data is encroaching onto new territory, including into areas where extensive consumer data has traditionally not been held.

Recent developments in Massachusetts serve as a case in point. In November, Massachusetts voters overwhelmingly approved Question 1, an amendment to the state's 2012 "right to repair" measure requiring vehicle manufacturers to make cars' onboard diagnostic ports accessible to independent mechanics, not just affiliated dealerships. Under Question 1, wireless data from vehicles' telematics systems must also be made available via a standardised open data platform starting in model year 2022.

The amendment's passage reflects the reality that innovation in automotive technology has made telematics much more critical to today's vehicles. And as advocates have argued, owning a vehicle should also mean owning the data it generates. Consumers should

> "Drivers attempting DIY repairs at home could inadvertently jeopardise their own safety and that of others, with public roads turned into trial grounds for testing the effectiveness of their repairs

“

This well-intended measure may yet open a Pandora’s box of complications including automaker liability, a heightened threat of cyber attacks, and a range of other public safety risks

have the freedom to choose where they take their vehicles to be repaired. Question 1’s passage makes that easier.

But the Massachusetts initiative could soon collide with another, far older law—that of unintended consequences. This well-intended measure may yet open a Pandora’s box of complications including automaker liability, a heightened threat of cyber attacks, and a range of other public safety risks.

Lawyers may well find themselves the biggest winners. Say an independent repair shop makes a fix involving a vehicle’s software. Soon after, a software-related accident or malfunction ensues. Who is liable: the OEM that provided the underlying software or the repair shop that fixed it? How much legal exposure does the independent shop face if it didn’t tinker with but merely accessed a car’s telematics data? The answers to these questions aren’t spelled out in Question 1, despite millions of dollars and entire livelihoods being at stake.

Meanwhile, for all the advantages of open data, it doesn’t come without major risks. As cars grow increasingly connected, running on hundreds of millions of lines of code, they are also more vulnerable to cyber attacks. Opening a vehicle platform could mean easier access for hacking safety-critical functions, including connected cars’ engines, steering wheels, and brakes.

No less troubling, there is nothing in Question 1 to prevent those without proper automotive training from altering vehicles’ electronic systems if they have access to telematics data. Drivers attempting DIY repairs at home could inadvertently jeopardise their own safety and that of others, with public roads turned into trial grounds for testing the effectiveness of their repairs. Because the code in a vehicle is engineered and integrated by software developers, car mechanics—let alone ordinary drivers—will not necessarily have the skillset or know how best to fix an issue without risking unintended harm on the roads.

In passing Question 1, Massachusetts voters have reaffirmed the importance of giving people more say over their own data. Now policymakers and industry stakeholders must respond to these public demands and formulate standardised, sensible rules that reflect the new automotive landscape, thereby protecting public safety, data rights, and the future of automotive innovation.

The opinions expressed here are those of the author and do not necessarily reflect the positions of Automotive World Ltd.
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How did COVID-19 change urban mobility?

Greater digital insight and on-demand offerings could be key in bringing commuters back to city centres. By Jack Hunsley

COVID-19 has placed the mobility industry under huge strain. Automakers and suppliers have battled supply chain disruption while their financial positions weakened. For those in the shared mobility business, the picture is even bleaker, with revenue streams evaporating overnight.

Uber is perhaps the best example. In February 2020, Chief Executive Dara Khosrowshahi told investors it could achieve profitability before 2021. A month later, Khosrowshahi told these same investors that Uber's ridership was down by 70%. Though Uber did weather the storm some key projects had to be sacrificed, namely its Advanced Technologies Group which was bought by Aurora in December.

As ridership plummeted over 2020, one set of players had unparalleled access to the very latest figures: shared mobility aggregators. By offering commuters the ability to browse and pay for a wide range of mobility offerings through a single app, these companies gained insight into commuter attitude shifts throughout the year.

2020 findings

"We've seen during the pandemic that many public transit operators have reduced the number of routes they run and the frequency with which they run vehicles," said Yovav Meydad, Moovit's Chief Marketing Officer. Meydad was speaking with *Automotive World* on the publication of Moovit's annual mobility study. "People had to wait longer at stops because buses came less frequently. The average walking distance also increased as more commuters had to walk longer to get to bus stops on lines where buses were still in operation."

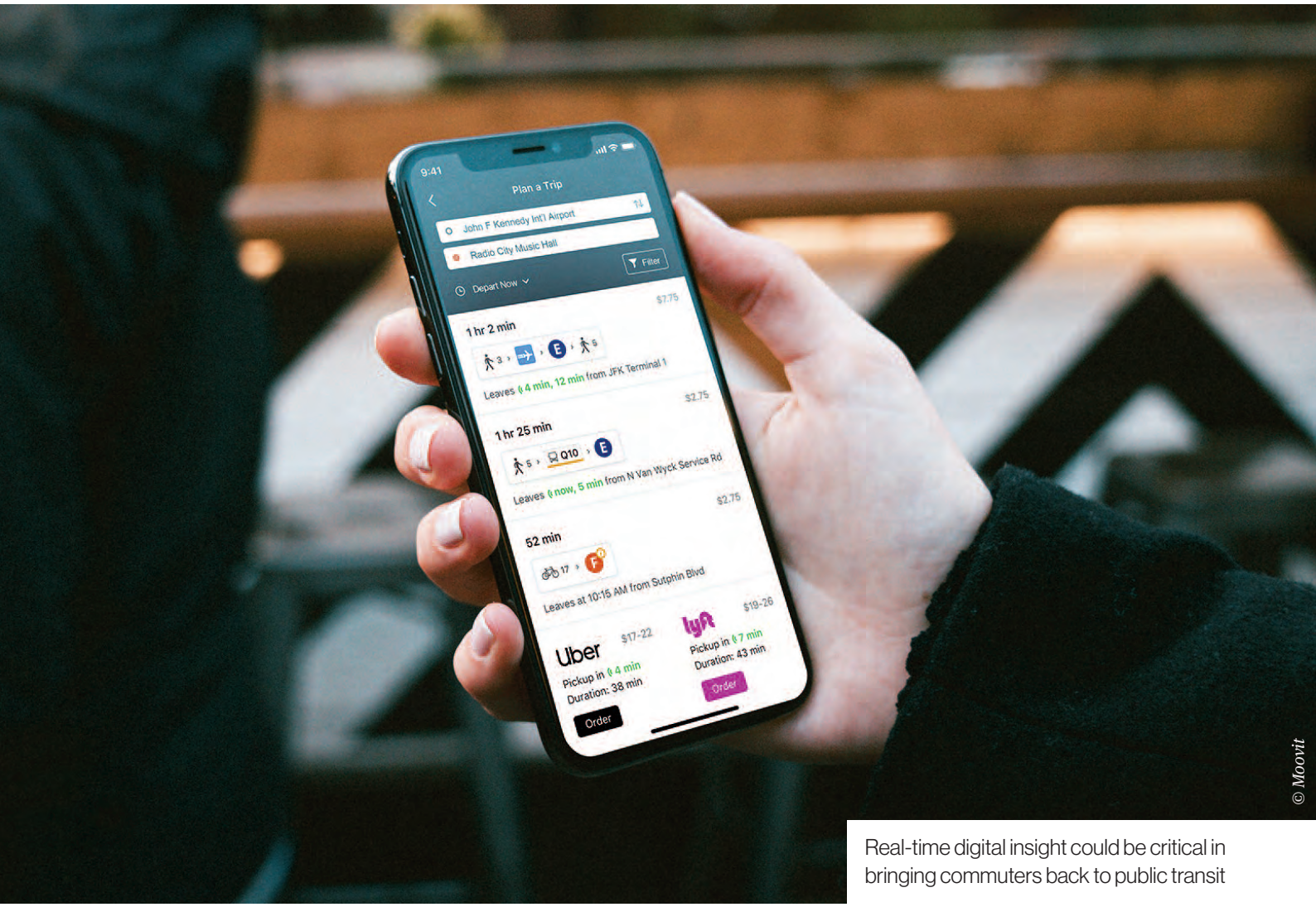
Moovit's findings stretch beyond fixed ridership figures. It also put several qualitative questions to tens of thousands of its users to understand how their attitudes had shifted in 2020. One finding, for instance, was that public transit usage dropped not solely because of concerns of contracting the virus within the bus itself, but the potential to be infected while waiting for a bus to arrive. "We saw that people do not want to wait at a bus stop because it's an opportunity

for the virus to spread," said Meydad. "Ideally, people prefer to be at a bus stop with the least number of people as possible."

An uptick in interest for mobile payment was also noted, as was an interest in access to real-time arrival information and to the current occupancy level of any given vehicle. If operators had not realised prior to 2020, these findings suggest digitisation should be at the top every stakeholder's agenda. "The reason we produce this report and release it free of charge is to help policymakers, whether they work at the municipal level or at the public transport level," added Meydad. "This report can offer guidance to make arrangements in the future and prioritise the development areas where they want to focus and where they want to improve based on real data."

Post-COVID-19 recovery

How can the industry expect mobility to recover? As Meydad highlights, usage has crept back up slowly since initial lockdowns were lifted, but there is still a way to go. "Since late March we've obviously seen significant decrease in public transport usage, as reflected by a decrease in usage of the Moovit app," he said. Moovit believes



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Real-time digital insight could be critical in bringing commuters back to public transit

> At that March peak, there was an 85 to 90% decrease in public transport usage levels compared to January. Since June we have seen it climb back up by 60%, 70%

its app usage data shows a strong correlation to overall ridership usage. "At that March peak, there was an 85% to 90% decrease in public transport usage levels compared to January. Since June we have seen it climb back up by 60%, 70%. Things are much better, but it is still not at the levels that it used to be."

Traditional public transit may recover slower than newer offerings such as micromobility and ride-hailing. This is partially because these new models are already highly digitised, but also because, in the case of micromobility in particular, it is much easier for users to socially distance. On this latter point, Moovit has also noticed more commuters shunning transit altogether and instead opting to walk more.

Recovery will also vary according to location. "Specific countries will go back to normality quicker," Meydad added. "We're looking forward to seeing when all of the European countries will recover, but in countries like Australia, for example, we definitely see usage already returning close to January 2020 levels."

The pandemic may also help invigorate more on-demand solutions such as microtransit. "These vehicles have smaller capacities and passengers do not need to wait at a certain bus stop together with other people," said Meydad. "The pick-up point is flexible. There is the option to pre-book and pay in advance using mobile payment. This is an area that we see many transport operators exploring through pilots and programmes." It is unlikely, however, that traditional public transit will fade away completely. "These options are not a complete alternative to buses but represent a way to supplement services, potentially in rural areas and to address first and last mile challenges," Meydad added.

Even as vaccine rollouts tick up and national lockdowns continue to slowly bring the virus and the death toll under control, it remains far too early for the automotive industry to fully understand the long-term impact of COVID-19. What is certain, however, is that change is on the horizon, and operators will need to be prepared to rapidly pivot to reassure their customer base.