

# Automotive World MAGAZINE

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A futuristic Hyperloop train is shown traveling on a track that spans across a body of water and a cityscape. The train is sleek and aerodynamic, with a blue and silver color scheme. The track is supported by a series of white, curved pillars. The background features a city skyline with various buildings and a bridge, all under a warm, golden sunset sky. The overall scene is a blend of modern technology and urban environment.

## Beyond the hype: Hyperloop's promise grows louder

**DeepRoute.ai's** CEO promises affordable high-level autonomy | **ICE** improvements rival EV advances |  
**Hyperloop** edges closer to market reality | **Continental** jockeys for new mobility leadership |  
**Stellantis** spotlights dynamic wireless charging | **Hexagon** CEO sees huge business opportunity in sustainability

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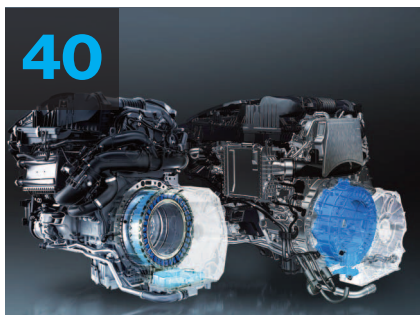
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*Cover image courtesy of HyperloopTT*

# Beyond the hype: Hyperloop's promise grows louder

Megan Lampinen visits HyperloopTT's Toulouse testing ground for a first-hand look at this potentially revolutionary transport tech



© HyperloopTT

**H**yperloop technology could revolutionise the way people and goods are moved, addressing many of the pain points associated with travel today and potentially reversing urbanisation trends. This vacuum tube-based concept uses magnetic levitation to lift and guide capsules from one place to another, with linear electric motors for acceleration and braking. The tubes are held up by a network of pylons, spaced out at regular intervals. The capsules can convey people or goods at nearly the speed of sound.

This is arguably the only mode of transportation that is completely insulated from outside forces, removing the principal form of resistance faced by all transport modes—air. “Put your hand outside the window of a car and even at a low speed you can feel that air resistance,” says Alexandre Zisa, Vice President of Programmes at Hyperloop Transportation Tech (HyperloopTT). “This is what we are removing, thanks to the tube.”

HyperloopTT is just one of several companies currently pursuing the technology. Elon Musk’s Boring Company and Virgin are also pouring money into their own Hyperloop visions, though everyone remains in relatively early stages of development. *Automotive World* recently explored [HyperloopTT’s test site and R&D Centre in Toulouse, France](#), where full-scale tests are being run.

## Up close

“At the start we will shoot capsules that reach 750kph,” says Zisa. “We do not see any obstacle to going from standstill to 1,200kph, but it will



**Alexandre Zisa,**  
Vice President of Programmes, Hyperloop  
Transportation Tech (HyperloopTT)

require technologies that are not mature enough today.” HyperloopTT is taking a pragmatic approach to get this technology to market—the estimate from insiders at the Toulouse location is that this could be commercialised in less than ten years. With market launch in mind, the company is currently integrating existing technologies with the more modest speed estimate. Down the line, it plans to “push the boundaries” and take this closer to the speed of sound.

The overall speed of any journey will depend on the straightness of the route. The straighter the route, the faster the journey. But it could also prove the most expensive option, as running directly from Point A to Point B could entail buying up houses or tunnelling through a mountain. Incorporating a few turns would slow down the journey but could prove much less expensive.

“The turns are directly connected to the speed,” Zisa explains. “You can do a 90-degree turn if you want to, but you will need to stop. Because speed is



HyperloopTT R&D centre in Toulouse

© HyperloopTT

part of the solution, that isn't a great approach." The planners of each specific route will need to weigh their options and come up with the one that makes the most sense in terms of the speed/cost balance.

Even with turns or stops, this represents an incredibly energy-efficient form of transport. Musk has estimated that a Hyperloop journey would consume just one-twentieth of the energy of a comparable trip by airplane. That's thanks to the use of magnetic levitation. "Up to 300kph, the most energy efficient system is the wheel," explains Zisa. "After 300kph that wheel starts having mechanical constraints." Most Hyperloop concepts would eliminate the need for rails and wheels except near stations and stops, and minimise energy losses due to air resistance, heat and friction.

## Fast travel, profitable operations

Why are companies pouring time and money into this? A big part of it is about making a profitable mode of transportation. Compared to open systems, this insulated approach is much less complex, and that translates into lower installation and operating expenses and hence more profit for operators. "Cost is really at the heart of our vision," he explains. The current estimate is that this could turn a profit in 20 to 25 years for the cities that install it. For railways, the wait for profitability is generally 50 to 100 years.

"If the taxpayer is going to pay for the initial construction, it won't be a subsidy," Zisa says. "It will be an investment with a payback. Most



importantly, it opens the door for public-private partnerships, which means that the public define where they want to have the infrastructure while private investors providing the financing.”

And the ticket price? “It will cost somewhere between a ticket for the train and the airplane, but closer to the train,” Zisa predicts. Musk previously suggested a one-way passenger journey from Los Angeles to San Francisco could cost about US\$20.

Another key aspect with Hyperloop is the speed at which it travels. Hyperloop is optimised at higher speeds and can address needs that are not met by today’s railways or airlines. That is not to say Hyperloop will compete against them, though. With the set infrastructure, it cannot offer the sort of destination variation that an airline could. Rather, it is envisioned as filling a gap in current infrastructure.

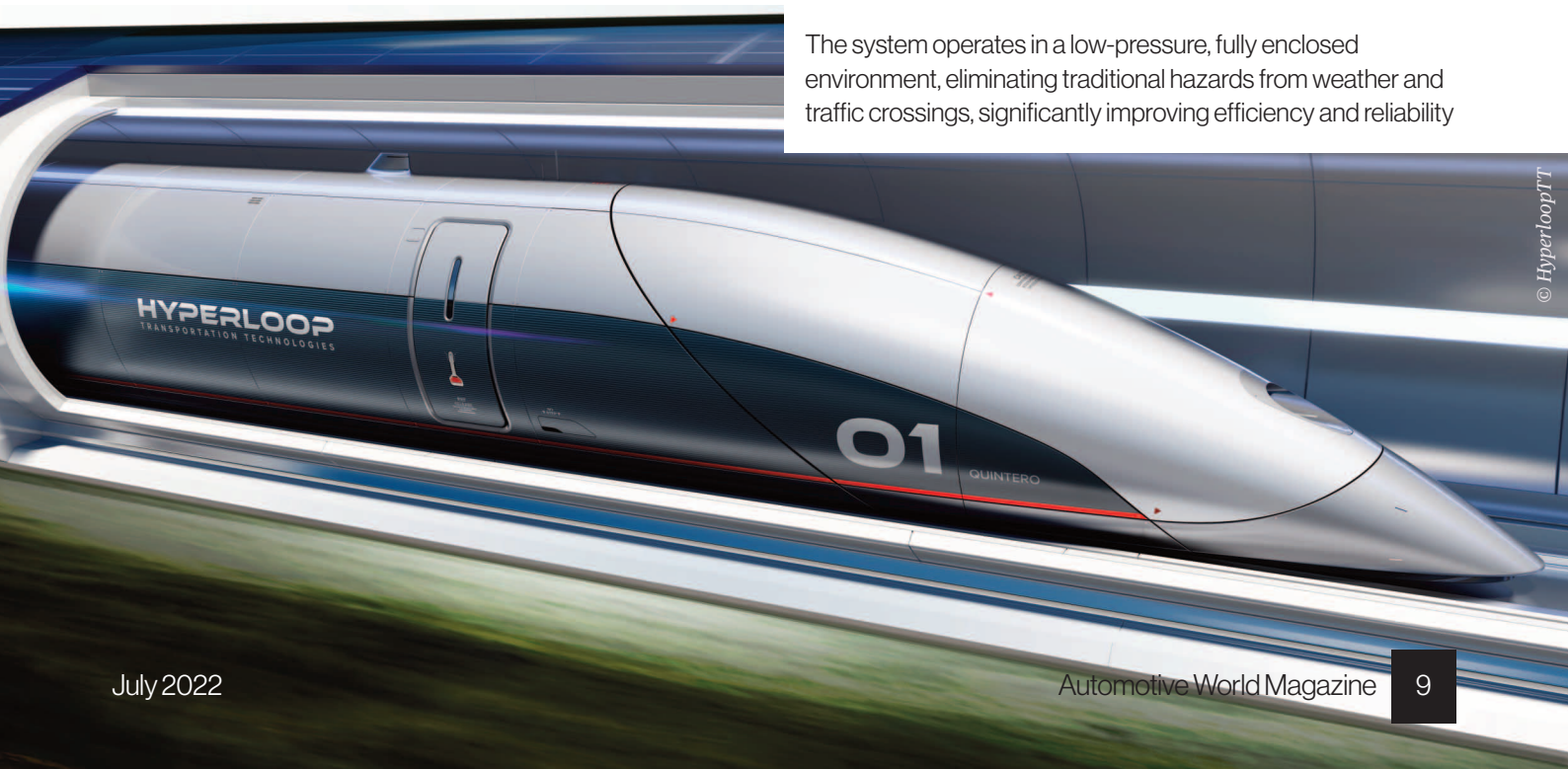
Musk has previously commented how he sees Hyperloop replacing short flights for medium-length city-to-city journeys, such as those between San Francisco and Los Angeles.

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We do not see any obstacle to going from standstill to 1,200kph, but it will require technologies that are not mature enough today

HyperloopTT flags a Chicago to Cleveland route as an example of one potential application. The city’s O’Hare airport is far away for most residents, and as much time is generally spent getting to and waiting at the airport as it is in the air. There is no direct rail route, and with connections and stops it would take three to four hours. HyperloopTT thinks it could offer this trip in less than an hour.

The system operates in a low-pressure, fully enclosed environment, eliminating traditional hazards from weather and traffic crossings, significantly improving efficiency and reliability



© HyperloopTT



“Think of us like electric scooters—love them or hate them,” says Zisa. “Scooters are not taking market share away from taxis or buses. They are plugging a gap. We are the same. Both of us are just offering a better solution for some use cases.”

When carrying passengers, the capsules should be able to take between 20 and 50 people, but goods delivery will be equally important. HyperloopTT has two configurations under development, with a different interior for either passengers or goods. The same capsule could be configured for passenger transport during the day and at night switch over to delivering goods. “There is a

very strong demand from the freight industry in general,” notes Zisa.

## How soon?

By radically reducing journey times, the Hyperloop could also transform the concept of the daily commute and wider urbanisation trends.

What happens to property prices in central Paris or New York City if you can come in from the surrounding countryside or a neighbouring state in half an hour? That’s a subject for another discussion but one that will need to be had in the coming years as progress on this transportation mode accelerates.



© HyperloopTT

HyperloopTT has filed more than 40 patents, operates a full-scale test track, and has even provided an insurance framework and certification guidelines in preparation for passengers. Official figures claim it has signed agreements with more than ten governments, but interest has been shown by many more. “We see interest for the system in the US, South America, China and even in Europe, which is surprising as here we have amazing infrastructure already in place,” notes Zisa.

While nothing is likely to appear on the market before the early 2030s, developers like HyperloopTT are bullish on the outlook. “Technically we have a pretty good understanding on

how to do this,” Zisa tells *Automotive World*. “There are the usual challenges you get with any new technology project, but nothing crazy.” One of the challenges at the moment is to put in place the necessary regulation for certification. The company is currently in talks with authorities in Europe and in the US on this front, but the key is to move quickly. “I’ll put it in this way: we do not see insurmountable obstacles anymore,” he adds. “Most of those have been solved. In some cases like the 750kph speed cap, we have a compromise to be ready sooner, and that’s our current mindset. On the whole we are convinced that the market will welcome this solution very well.”

# Safety standards capture state-of-the-art, in snapshot



Megan Lampinen takes a deep dive into ISO 26262 with a member of the international team that helped develop this pivotal standard

Vehicles have been incorporating increasing amounts of electronics content over the past few decades. It really kicked off with the introduction of engine management systems for emissions control in the 1980s, marking the first use of microprocessors and software in vehicle control systems. Every decade since then has witnessed a similar step change in content. In the 1990s it centred around restraint systems, which started to become commonplace in mass market vehicles. In the 2000s it was stability control. In the 2010s it was driver assistance systems like adaptive cruise control and lane departure warning.

This past decade has seen a big push with powertrain electrification as more electric vehicles (EVs) and hybrids

make their way on to the road. Today, a typical vehicle will have electrical powertrain components, a suite of driver assistance features and connectivity capability. As a result, the electronics systems are becoming more central to how the vehicle operates, and it's pivotal to get them right.

“We must be able to trust these systems to do the right thing,” says David Ward, Senior Technology Manager—Functional Safety, at automotive engineering and development consultancy Horiba Mira. “We simply cannot have the automotive equivalent of a blue screen of death, like what happens occasionally on a computer. In the case of a computer failure, we tend to shrug our shoulders and just reboot, but you can't do that if it involves a safety system on a vehicle.”



## Codifying common practices

It is against this backdrop of growing use of electronics and increasing dependence on software that the automotive industry decided to standardise certain practices and procedures. In 1994 Horiba Mira led the MISRA Project, which produced some guidance around functional safety in the context of vehicles. “That was initially helping to codify some common practices around the way that we develop software for safety-related applications in vehicles,” explained Ward. The consensus was that this represented a great starting point but that an international

standard was needed, something that could be held up as the go-to industry approach for development of vehicle electronic systems.

Work started in 2005 at the international level to develop what became ISO 26262. Ward, who was part of that development team, testifies to the passion and hard work—and compromise—that went into it. “Any standards-making activity is supposed to be a consensus,” he tells *Automotive World*. “When you come together in an international forum, inevitably there will be different opinions and perspectives, but the idea is to reach an agreement. There were many interesting discussions along the way, but

that’s a feature of any standards development. Despite the different approaches from different nations, ultimately the industry got together behind this standard.”

The first edition of ISO 26262 was published in 2011 and applied only to passenger cars, though light trucks and buses were formally brought into scope in the second edition, which launched in 2018. “There’s always room for improvement,” says Ward. “I was generally satisfied that we had an industry approach, though we knew there were several areas that could have been improved. The important thing was to address the critical issues.”

## Different classes of failures

At its heart, ISO 26262 addresses ‘things gone wrong’. That’s all about possible hazards caused by malfunctioning behaviour of electronic/electrical safety-related systems, tracked back to something like a mistake in the software or a fault in the hardware. But advanced driver assistance systems and high levels of automation introduce another class of failures that relate to how well sensor systems detect the environment. “Part of it is because we can’t anticipate every situation that a sensor system like a radar or a camera will see,” explains Ward.

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ISO 26262 is deeply embedded into the way most automotive organisations approach electronic system development

A parallel standard, Safety of the Intended Functionality (SOTIF), will soon be published to cover the correct performance of things based

on sensors, data fusion and AI. This was previously considered for inclusion within 26262 but the team felt it was dealing with another aspect of system safety. “We use the term ‘functional safety’ to talk about safety that depends on a function being delivered correctly and not being affected by a malfunction, ultimately by a fault in the hardware or software,” explains Ward. “We use the term ‘system safety’ as a higher-level term that encompasses other factors about how well a system operates. We would see SOTIF as being a system safety factor that sits alongside 26262.”

To be clear, he does not see this as a rival to 26262 but part of the wider safety picture. “There are several factors that support achieving a safe product. One is making the product robust against malfunctions in hardware and software,” he clarifies. “Another aspect is making sure that sensor systems and things like that are sufficiently robust both against the things we know about and the things that we don’t know about.” A preliminary document on SOTIF is currently available but developers are still in the process of preparing the final version for release later in the year.

Cyber security is another aspect of vehicle safety closely linked to functional safety but covered by a separate standard, ISO 21434. The term generally refers to concerns around financial transactions, personal data and operational limitations, but at the same time a cyber security incident in automotive could potentially have a safety related outcome as well. “It is important that we don’t look at functional safety, SOTIF or cyber security in isolation,” says Ward. “We

must have a joined-up approach to dealing with it, and that's a pretty important topic in itself."

## Further developments

Any standard effectively codifies what the industry is doing at a point in time. "It's a snapshot of the state of the art," he says. "We recognised that many people were already doing the right thing in terms of designing electronics in software in vehicles but we wanted to codify that right thing."

Because the standard can only reflect best practice as of the current moment, it will eventually become outdated. The International Organisation of Standardisation has its own rules about how often standards should be updated. When 26262 first came out that period was three years. It's now five years. Edition 2 came out in 2018, so it will be time for a review at the end of next year. "There are areas that we need to update or give further guidance," Ward notes. "On the one hand we want to give some stability and continuity to users of the standard, so we are not producing new versions every six months. Then they would find themselves dealing with a moving target."

At the same time, the standard needs to reflect the changes that are taking place. A common compromise is to publish an intermediate document laying out a position, while the team will later decide whether to integrate that into a future update of the standard. This is exactly what's happened over the past few years. The first edition of 26262 provided some guidance about dealing with semiconductor devices but it quickly became clear that more was needed

and it couldn't wait for the second edition. An intermediate document was released that was later subsumed into Edition 2 of the standard as an additional chapter.

This approach continues. "There are probably three or four topics that we're actively considering as areas that might need future updating in 26262," Ward notes. "There are also three or four other separate documents being worked on that might go on to become full standards or might influence the content of 26262." This includes a document specifically about the safety of automated driving that's being worked on separately from 26262 but with many of the same experts—including Ward—involved in it. There is also another document under development looking at the safe use of AI and machine learning.

## Flexibility to adapt

Today, ISO 26262 is deeply embedded into the way most automotive organisations approach electronic system development. But it's not simply an exercise in ticking boxes. The standard provides a structured approach to creatively solve engineering and design challenges.

"It has to be set up to give companies the flexibility to adapt to a new challenges," emphasises Ward. "There are one or two places in the standard where we've deliberately futureproofed it. If you want to deviate from what's explicitly written in the standard, then there are ways to do that, provided of course you record the rationale for how you've done that. Above all, it is very much an active thing."

# L4 autonomy could cost just US\$3,000/vehicle, says DeepRoute.ai's CEO

DeepRoute.ai's Maxwell Zhou is confident that affordable high-level autonomy is just around the corner.  
By Jack Hunsley





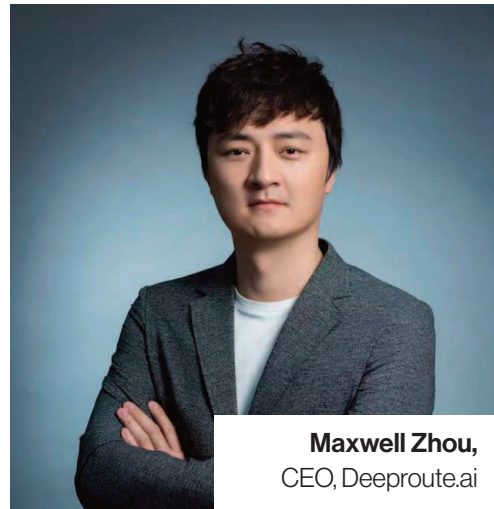
**A**utonomous vehicle development is an inherently expensive endeavour. The array of different sensors required, along with the necessary software development, IT expertise and data shortage can very quickly see operating and development costs skyrocket. Though more Level 2 and even Level 3 solutions are becoming affordable for deployment in premium models, the expectation is that Level 4 and Level 5 autonomy remain many years away for this very reason. However, not all stakeholders subscribe to this motto.

One naysayer is China's DeepRoute.ai. Founded in 2019, the company has made a name for itself by drawing in sizeable investment from players such as Alibaba and tying up partnership deals with the likes of Dongfeng Motors, Cao Cao and Nvidia. As its Chief Executive, Maxwell Zhou, told Automotive World during an exclusive interview, DeepRoute.ai believes mass production Level 4 autonomous mobility could be achieved for as little as US\$3,000 a vehicle.

### **Can you walk me through DeepRoute.ai's journey to date?**

We were founded in February 2019 and in the past three years we've seen very fast growth. The reason is that we've collaborated closely with players like Nvidia.

We have the largest robotaxi fleet with production ready solutions at affordable prices. The list price for our latest generation vehicle is US\$10,000 with solid-state LiDAR, an Nvidia Orin automotive grade chipset and mass production HD maps.



**Maxwell Zhou,**  
CEO, DeepRoute.ai

© DeepRoute.ai

In 2021, we also raised more than US\$300m from the Alibaba Group. They are our strategy investors. With that we also announced that we're closely collaborating with Alibaba on automating urban logistics with medium duty trucks. We're also partnered with Dongfeng Motors to co-develop robotaxis, and with ride-hailing company Cao Cao, the second-largest ride-sharing company in China.

We have also helped out during the COVID pandemic. In 2021, we used our autonomous vehicles to help deliver COVID testing samples. In 2022, we're using our trucks to deliver food and medical supplies.

### **The robotaxi market, especially China's, is extremely competitive. What separates DeepRoute.ai from the competition?**

We entered this market with the endgame already in sight. If you want to achieve Level 4 autonomous driving, it must be affordable. If you look at companies like Waymo, its solutions are so expensive, more than US\$100,000 just for the hardware. That cost is unacceptable for normal customers. We believe that US\$10,000 is the maximum price that can be accepted by the market.



DeepRoute says it can enable Level 4 autonomy at a fraction of current costs

### **How can you enable Level 4 autonomy at that price point?**

Many of our competitors that are working on robotaxis are using high-end hardware. They'll have, for example, two high-end gaming graphics cards onboard and a very expensive GNSS setup. We have instead built our algorithm to fit with more affordable hardware.

When it comes to collating real-world data, most of our competitors are also opting to follow Waymo's footsteps. Most choose places with very little traffic and road users; Phoenix is basically a ghost town. Some, however, like Cruise in San Francisco, are choosing very busy areas, and we're doing the same with our road tests in Shenzhen.

### **Do you see opportunities for even further cost reductions in the future?**

For our next-generation driver, the cost per vehicle will be around US\$3,000. To do that we must collaborate with OEMs. A Waymo can only buy a few LiDARs, but, with production scale, OEMs can buy millions as they know they are going to be used.

You can also reduce the number of sensors per vehicle. For example, you do not necessarily need five LiDARs per vehicle and can instead place LiDARs only where necessary and combine this with lower cost sensors.

There are also opportunities to optimise and develop toolkits to reduce the computing power

“

By 2024 or 2025, we expect millions of cars to be mass produced and on the road, ready for customers to purchase

requirements. We're using an Orin system on chip to enable Level 4 autonomy, but our competitors are using 3090 Nvidia graphics cards for that. That is a huge difference in the chipset.

Bringing the cost down is very important. Eventually, autonomous driving must be affordable.

**What is your roadmap for taking these vehicles to mass production?**

Currently we are working on several proof of concepts with OEMs. By 2024 or 2025, we expect millions of cars to be mass produced and on the road, ready for customers to purchase.

**When you say 'customers' are we talking private customers or shared mobility players?**

Both. We hope that everyone will be able to purchase such a vehicle. What we might see, however, is that the vehicle can operate at Level 4

autonomy in certain areas, but at Level 2 in others if we do not have enough data in certain locations.

**How quickly do you expect to be able to expand Level 4 functionality?**

That is highly dependent on how many cars are sold. We believe that the necessary data will come from two sources: individual cars and fleet operators. On the latter, if, for example, we want to expand Level 4 outside the major cities, our fleets can collect that data for us.

**What's the roadmap for DeepRoute.ai and the robotaxi sector through the rest of this decade?**

By the end of this decade there will still be many human driven vehicles on the road, but I believe the visions we see in things like sci-fi movies will have started to become reality. My hope is that DeepRoute.ai will talked about the same way household name players in this segment are today.

# The self-cooling car to further sustainability push

SolCold's nanotech coating turns the sun's power into a cooling mechanism for vehicles. Megan Lampinen hears more

Vehicle air-conditioning units consume vast amounts of energy, while the fuel they run on and the leaks of their refrigerant produce significant levels of greenhouse gas emissions. The International Energy Agency estimates that mobile air-conditioning across passenger cars, vans, buses and freight trucks could consume more than 5.7 million barrels of oil equivalent per day by 2050, if nothing is done about it. The good news is that promising technology advances could dramatically improve the situation.

## SolCold

Israeli start-up SolCold has developed an environmentally friendly material that helps to cool the temperature in a vehicle. Its

magic lies in a process known as Anti-Stokes Fluorescence: when sunlight comes into contact with the coating, it triggers a reaction that converts heat into radiation, providing a cooling effect. The material's cooling effect is only reinforced by the strength of the sun's rays. Applying this material as a vehicle coating could slash its power consumption by up to 60%, expand the range of battery electric models and reduce the strain on electricity grids.

"Once our coatings are outside in the natural environment, exposed to sunlight, the active cooling mechanism inside reduces the temperature of whatever they are touching to below ambient temperature," explains SolCold Chief Executive and co-founder Yaron Shenhav. If the material is touching the rooftop of a car, it will cool down the car. If it

touches a balcony, then it will cool down the balcony. It works on almost any surface outdoors.

The coating is a sticker measuring about 350 microns or one-third of a millimetre thick. Inside it has four layers, and in layers two and three lie the cooling engine. "Here reside the nanoparticles that are doing Anti-Stokes Fluorescence while other molecules do black-body radiation. There are two different types of physics phenomena working together in different wavelengths to lose their own energy," he says. "Once they do that they drop in temperature."

The effect is notable. An object placed in the sun and coated with this material is about five degrees cooler than the same object without the technology placed in the shade. Compared to an object

coated in reflective white paint, which is frequently used to cool rooftops, it is about 12 degrees cooler. Compared to a grey or black colour, it is 20 degrees and 30 degrees cooler, respectively.

Shenhav claims its performance puts SolCold at the forefront of industry-wide developments: “There are several start-ups also trying to reach this sub-ambient goal and we beat them all. That includes start-ups from Japan, China and the US.”

## Automotive applications

The material is applied like a vinyl coating. “It is quite flexible but the application process for automotive will require some more fine tuning,” Shenhav concedes. That should take about one year to perfect, he estimates. The only substantial limitation beyond that could be the colour choice: any colour you want as long as it’s white with a minor greenish tint. That cannot be changed without damaging the cooling efficiency.

It hasn’t seemed to put off interested parties. SolCold has been developing its material over the past three years but outside interest recently began to pick up. “As of November last year we had no business activities at all and by April this year we had 300 companies approach us with some kind of cooperation offer,” Shenhav tells *Automotive World*. So far it has signed agreements to start piloting with 15 partners. These are all paid pilots, and this year the company has raked in sales of US\$1m just from pilots.



DeepRoute says it can enable Level 4 autonomy at a fraction of current costs

The projects cover a handful of use cases, including outdoor electronics, large industrial facilities and automotive.

SolCold’s automotive activities include a project with Hyundai on freight trucks as well as a wide-ranging partnership with Volkswagen. The latter has been following developments at the start-up since 2017 through its Israeli scouting branch, Volkswagen Konnect. In summer 2021, the two worked on a proof-of-concept in which researchers coated a vehicle with SolCold’s material and exposed it to the Israeli sun. Initial tests were conducted on an old Suzuki Ignis but VW then brought in two new Polos for testing, followed by a California model. The results were convincing: at the peak hours of the day, the material reduced vehicle temperatures by 12 to 14 degrees.

VW plans to showcase the coating technology in an upcoming car of the future concept to be displayed in Las Vegas in late 2023. “We are

deepening the VW collaboration and forging closer ties,” Shenhav emphasises. The big-name backing could certainly bolster industry confidence in the technology, but at the same time the size of the VW Group could make a notable environmental impact. “As the largest car company in Europe, Volkswagen Group using SolCold technology could decrease the carbon emissions associated with air-conditioning in transportation,” he notes.

If this does find its way into production vehicles, the coating will have the biggest impact on those regions that experience particularly hot weather, and initial target markets include China, Brazil, and Mexico. In the long run, SolCold is confident it will make a sizeable contribution to wider sustainability efforts. “The impact is very significant, but for that we need fast scalability and to partner quickly with good companies to bring this to market,” says Shenhav. “I believe that people could feasibly buy a self-cooling car in the next few years.”

# When will drone delivery take off?

Drones could become an integral part of future supply chains and smart city infrastructure, writes Megan Lampinen



**I**magine a goods delivery service that was immune to road traffic congestion and the constraints of asphalt, flying as the crow flies along the most direct route between any two locations. In theory, drones offer numerous benefits over traditional delivery services in the areas of cost, convenience and accessibility. If the admittedly considerable obstacles to widespread deployment are overcome, they could rewrite the rulebook for urban logistics.

traditional transportation for last-mile delivery. Thanks to their battery propulsion system, they are untouched by fluctuating oil prices. Battery power also helps on the emissions argument. As unmanned vehicles, they could slash labour costs associated with delivery.

Importantly, drones can fly in a near-direct path to their delivery site, making for faster and more reliable deliveries. This time-saving factor,

“

There is ample evidence to suggest that drones will be an integral part of future supply chains and smart city infrastructure

“There is ample evidence to suggest that drones will be an integral part of future supply chains and smart city infrastructure,” asserts Rohit Gupta, Vice President and Head of Manufacturing, Logistics, Energy and Utilities at consultancy Cognizant. “The benefits that drones offer in an urban logistics ecosystem—allowing for faster, efficient, cost-effective, and most importantly, sustainable delivery—makes them extremely appealing for the logistics industry.”

One of the main benefits is the lower cost involved: drones are relatively cheap to operate compared to

Gupta suggests, “could prove gamechanger especially for food, medicines, emergency supplies and perishables.” He points to the successful applications already seen in delivery of COVID-19 vaccines by UPS in Winston-Salem, North Carolina, using new cold chain packaging developed specifically for drones.

Gupta also notes that “due to inbuilt GPS technologies, delivery drones have better navigational capabilities and higher success rate compared to humans.” Provided there are dedicated corridors for drones, they



© Swiss Post

Swiss Post has been using drones for years

could prove a safer option than road-going vehicles.

## Deployments

With online purchasing showing now signs of stopping, and consumer expectations for quicker, same-day delivery slots, drones could play a central role in last-mile delivery solutions. It is still early days for such deployments, but a growing number of operators are exploring use cases.

“There are multiple successful examples of drones being used for carrying small packages, parcels, food delivery, vaccines and medical supplies, spare parts and military equipment as logistics and technology companies join hands to make slow and steady progress towards realising drones as a viable delivery channel,” Gupta tells *Automotive World*.

Big name players like Amazon, DHL and Royal Mail have been running trials, but with limited success.



Amazon's Prime Air programme, announced back in 2013 with huge fanfare, promised fleets of drones would be dropping off parcels on door steps within five years. However, progress has been slower than expected and certain regional drone operations have been wound down. The likes of DHL and Royal Mail have not gone beyond pilot stage.

On the other hand, Alphabet drone subsidiary Wing claims to have completed more than 140,000 customer deliveries in 2021, a 600% increase over 2020 levels. Swiss Post has been flying Matternet's drones beyond-visual-line-of-sight (BVLOS) over Swiss cities for more than four years. In November 2021, Walmart teamed up with Zipline to launch an on-demand delivery service of health and consumable items close to its Arkansas headquarters. Over in Ireland, autonomous drone delivery service Manna has completed 65,000 flights, delivering coffee and food products.

"It is not surprising to see that small scale and drone technology focused start-ups have been successful in making their presence noted by developing niche capabilities at a smaller scale, while the larger players struggle to scale their drone operations within the existing technology and regulatory constraints," says Gupta.

## Headwinds

Despite plenty of benefits on offer and interest among operators, drone delivery remains in the nascent stage. "The underlying technology, battery



efficiency, storage, payload size, processing capacity and costs are expected to improve as more investment is pumped into this space," says Gupta. Drone infrastructure will require a significant capital investment, though like all new technologies, as it becomes more mainstream, the economies of scale should help cut costs.

Then there are the power requirements. "There is always a risk of power running out resulting in failed deliveries or an unsuccessful return to base," Gupta points out. And the problem could get worse: as more intelligence is built into drones for



Wing delivers food, sweets, and household goods to select neighbourhoods in Helsinki

navigation and data communication, it will add more drain on the onboard batteries. The relatively high risk of failure also needs to come down before deployment becomes widespread. While Gupta concedes that the drones available today are at a higher risk of failure in comparison to traditional methods, he emphasises that this “is understandable considering the drone technology is on an evolutionary path and will take time to reach a steady state.”

Consumers have also voiced privacy concerns, as drones use GPS and cameras to find homes and deliver packages. But even more challenging could be sorting out the aerial congestion expected as drone use expands, which would increase the risk of collisions. “This will require developing dedicated drone corridors, building infrastructure for

safe take-off and landing, and defining regulations for safe operations,” says Gupta.

## Regulation gaps

Regulation could make or break the future of drones in urban logistics, and there are numerous angles that need to be addressed. “It is quite evident that the current regulatory framework is not able to support drone operations at existing levels,” says Gupta. “As the industry is anticipated to grow, it is necessary for aviation regulatory bodies such as EASA in EU and CAA in UK to create new or modify existing regulations related to drone operations.”

At the moment, there are variations of regulations from national, regional and local city bodies addressing drone

range, weight, speed, flight altitude and flying hours in the day. Gupta believes that the aviation authorities need to adopt “a common and consistent set of regulations and guidance, giving operators the flexibility to meet the regulatory mandates through qualitative and quantitative methods.”

On top of this, regulatory bodies also need to modify the right of way rules to include drones in low altitude airspace. One of the most important areas to address is the BVLOS use. In most instances, drones are not allowed BVLOS of the pilot, but if they are to carry out deliveries they will need to do so. “This means drones will need collision avoidance and safety intelligence. Such a standard framework will have to be implemented on all types of drones. Without it, there is a huge risk of collisions or loss of goods,” warns Gupta..

Regulations may also be needed to mandate remote ID for drones, meaning all units must broadcast a unique identification signal during their flight.


## Shaping the mobility ecosystem

The market for delivery drones is poised for considerable growth. Fortune Business Insights estimates the global drone package delivery market will grow from US\$1.52bn in 2021 to US\$31.19bn by 2028 at CAGR of 53.94% during that time. Local food deliveries, e-commerce, perishables and medical supplies are just some of



the more promising areas for growth in drone delivery.

But as Gupta is keen to emphasise, this mode “must exist within the ecosystem of existing transport options... In a race towards delivery

A large yellow banner with the Continental logo and name is visible on the left and right sides of the image. The background features a multi-story brick building with many windows under a clear blue sky. A dark semi-transparent rectangle is overlaid on the center of the image, containing the main title and subtitle in white text.

# From rubber to software, Continental epitomises mobility evolution

The CEO of Continental France talks megatrends and 150 years of history with Megan Lampinen

In this emerging ecosystem of new mobility, suppliers must be resilient and adaptable if they are to remain relevant. Decades of experience supplying vehicles is no longer sufficient to ensure survival in this new software-based domain, and market consolidation is inevitable. However, there are a handful of long-time players that, like the cockroach, appear able to withstand and even thrive in a period of rapid change. At 150 years old, Continental AG is proving it has what it takes to help shape the future of mobility.

## From handbags to autonomous vehicles

The German Tier 1 estimates that its technology is found in three out of every four global vehicles on the road today. That's not a bad boast for a company that started out over 150 years ago in a world very different to today. Its roots are in rubber, and its rubber-based products have found their way into everything from handbags to bicycles. With this knowledge it built up a solid reputation in vehicle tyre technology, but today its automotive business is all about software.

"We have positioned ourselves as a Tier 1 supplier mainly in electronics," says Stefan May, Chief Executive and Country Head of Continental in France. Continental has been active in France for just over 130 years. May has served in the top role since 2019 but



Continental celebrated its 150th anniversary in October 2021

has accumulated more than 30 years at the supplier and witnessed first-hand its evolution. He recently took *Automotive World* on a tour of the company's Toulouse facility, a hub for automotive electronics development, production and testing.

"The original idea was to integrate electronics in cars," he explained. "OEMs suddenly needed knowledge in embedded systems and that knowledge was found in the space industry." Toulouse is indisputably the aeronautics and space capital of Europe; it was the birthplace of the airborne postal service nearly a century ago and is currently home to Airbus HQ. "It made sense to take learnings from the space industry and apply it to automotive, as the expertise is the same," he emphasises.



© Continental

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It made sense to take learnings from the space industry and apply it to automotive, as the expertise is the same

That was a considerable jump from its roots in rubber. “Why did we move from rubber to automotive? It all focuses on safety,” he explains. “What are the things physically near a tyre?”

Brakes. Brakes ensure safety. In 1991 Continental bought a company active in brakes and that’s where this automotive diversification started. We never stopped buying automotive equipment specialists, which results in our current form today.”

It hasn’t just been buying, though. It has also been refining. In April 2021, shareholders approved the spin-off of its powertrain business into Vitesco Technology to focus on electric propulsion. “That was it—no more powertrain,” says May. “Why? Everyone talks about electrification. We think the leading industry positions in powertrain were already taken, unfortunately, by Asian companies. Europe lost this battle to some extent.”

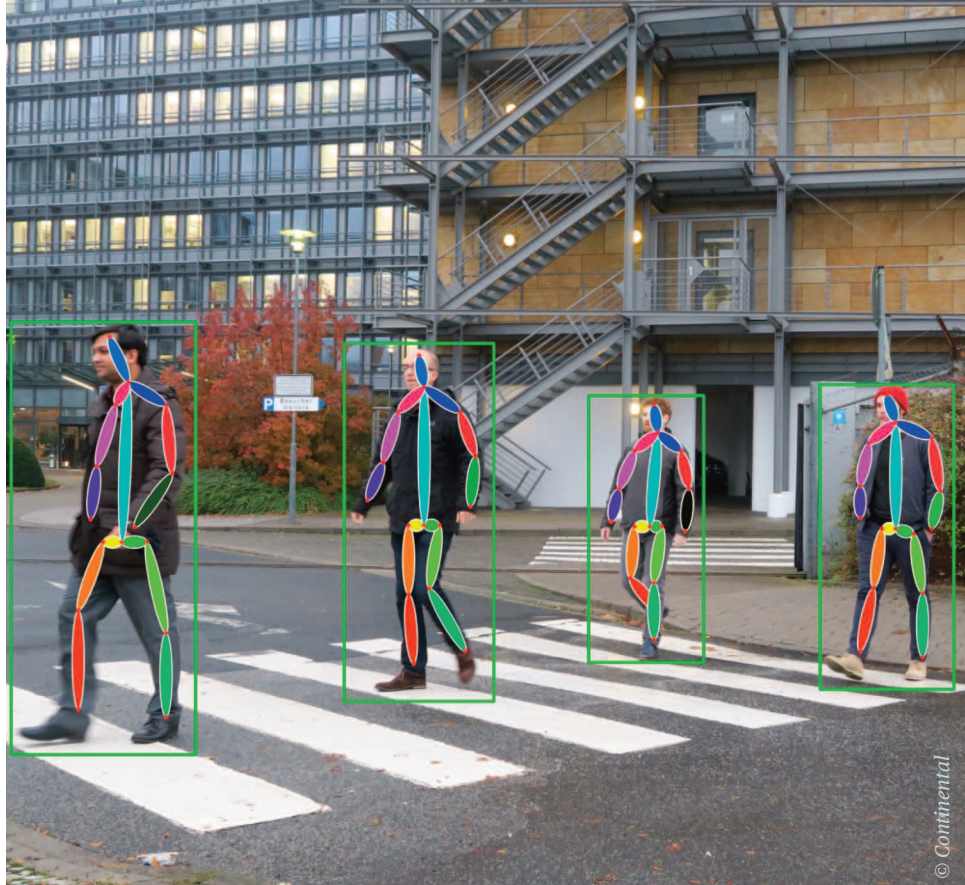
### Spotlight on software

It might have missed the boat on that particular application, but there was another on which it could more fully

capitalise: software. “We concentrate on the rest, and the rest is basically software. Software is everywhere. Software means automated driving and connectivity,” says May. “New architectures will come to life in 2025 and 2026, introducing more centralised zonal architectures. With these you need to make sure you are managing the complete software stack from embedded to cloud, including middle wear and the operating system.”

This is where Continental is now investing heavily. At the ITS European Congress 2022 (30 May to 1 June), based in Toulouse, the supplier is spotlighting some of its latest innovations on this front. This includes smart intersection solutions, a pedestrian detection system, a cloud-based ‘key as a service’ solution, an HPC to facilitate software updates and a 5G smart antenna demonstrator for vehicles. Meanwhile, the company’s production facility in Toulouse turns out such essential components as controllers, tyre pressure management systems and 5G antennas.

“We are working with various automakers on the software architecture to make sure the functions for which we stand—braking, connectivity, safety features, multimedia—continue to work in a different E/E architecture and environments,” notes May. “That leads to questions around cyber security and connectivity in all places. Does 5G need to be able to completely guarantee connectivity in all areas of the world? Perhaps not. It just means it might.”



He points specifically to the role that satellites can play in realising a connected mobility ecosystem, and Toulouse itself is a centre for satellite expertise. Down the road from Continental’s campus is the Airbus facility where a team of workers are currently hand-assembling a wide range of satellites for every conceivable application. “Toulouse is a satellite town,” says May. “We interact with people from the space industry to get more knowledge about that.”

Making the most of its location and the know-how to hand in this hotbed of engineering, Continental’s French division demonstrates the sort of initiative and adaptability that could see the company stick around for another 150 years. It’s what the cockroach would do. The group-wide objective at Continental is to become the benchmark for the mobility of the future. If progress continues at this rate, it stands a good chance of achieving that.



# It's too soon to say goodbye to internal combustion

Oliver Wyman experts argue that ICE vehicles are the cash cows funding the industry's transition into an electrified, software-dominated future





**M**ajor automotive markets are witnessing a rapid adoption of electric vehicles (EVs). In Europe, battery EVs accounted for 9.1% of car registrations in 2021, and regulations are in place to allow only sales of zero-emission vehicles beginning in 2035. But that leaves more than a decade when automakers will still look for a significant chunk of their annual sales to come from internal combustion engine (ICE) vehicles. This includes more environmentally acceptable hybrid cars, which rely on ICE alongside EV batteries for power.

Car companies recognise this and have no plans to abandon internal combustion powertrain production soon. Yet, some want to cut off their investment in ICE and vehicle platform R&D and focus all their resources on EV advancement. This would represent a missed opportunity to improve the efficiency and reduce the environmental impact of those ICE vehicles still to be manufactured, sold, and driven for many years to come. These automotive sales—which at this point are more profitable to manufacturers than EVs—are the cash cows funding the industry’s transition into an electrified, software-dominated future. Automakers can’t afford for that revenue stream to decline.

## Where should automakers focus

Further technological innovations are, in fact, necessary to allow internal combustion automobiles to remain a part of the sales mix. Consequently, rather than run away from ICE innovation, carmakers must develop strategies to achieve it efficiently without further stretching already thinly spread resources (and suppliers) or looking to customers to make up the difference.

A review of state-of-the-art research shows various technologies could be leveraged to achieve efficiency improvements. These could lead to potential reductions of CO<sub>2</sub> emissions from ICEs of between 10% and 15%, depending on the vehicle class, our calculations show.

Among the ways some of the new technologies achieve these gains is through improvements in exhaust gas recirculation, waste heat recovery, and exhaust gas thermal management. Additional emissions reductions can be realised by incorporating into modern engine design the advantages of low-friction coatings, advanced turbocharging and turbo compounding, electric intake cam phasers, water injection, and pre-chamber ignition. By leveraging the advantages of longer strokes, variable compression ratios, leaner combustion, or modern variants of the Miller or Atkinson cycles to a greater extent, emissions could potentially be decreased even further.

By implementing such ICE innovations, we estimate that about 16 grams of CO<sub>2</sub> per kilometer (gCO<sub>2</sub>/km) of emissions could be reduced in comparison to the current engine technology generation in a typical ICE-powered C-segment car. This is prior to any further drivetrain electrification. In other words, this translates into a saving of over 1,800 kilograms of CO<sub>2</sub> over a ten-year usage period if the significant potential of currently available technologies is leveraged to improve upon the current Euro 6-TEMP standard.

This would imply that in Europe alone, a total of almost 60 million tons of CO<sub>2</sub> emissions could be eliminated through ICE innovation alone. This is roughly what all cars in Spain emit in a whole year, or the equivalent of taking more than four million internal combustion cars off the road. These technologies could prove vital, given that carmakers must reduce CO<sub>2</sub> emissions 55% by 2030 compared with 2021 levels.

## Getting on the same page

That said, there are varying views on the development and economic feasibility of these innovations. Some industry experts, including The International Council on Clean Transportation (ICCT), believe that the required technologies are largely available and feasible, while others argue that the cost of implementation would be too high for many vehicle segments. But given the potential savings, further investment to resolve the disagreement seems warranted.

In parallel, more advanced technologies are also currently being investigated. This includes using synthetic or e-fuels in ICEs. Current estimates suggest that the switch would result in fewer emissions compared with a corresponding Euro 6 ICE vehicle today.

Some players are also investigating the use of hydrogen as a fuel for combustion engines, which would be a zero-emission option. While this alternative is still quite expensive, there could be potential with specific use cases and niche applications.

## Nitrogen oxide efforts

Apart from CO<sub>2</sub> emission reductions, regulatory focus is also on nitrogen oxide (NO<sub>x</sub>) emissions, with the next undisclosed iteration of Euro 7 targets expected to be much more stringent. The new regulations are likely to come into effect in the second half of this decade, which leaves automakers to guess what to aim for in the meantime.

Current emission control systems already convert NO<sub>x</sub> emissions with over 99% efficiency in highway driving

conditions, but further work is needed to cover higher emissions in urban driving conditions. Technologies, such as larger catalyst volumes, continued powertrain hybridisation, and advanced aftertreatment, are being developed to this end.

Industry experts estimate that such innovations can be implemented without too many costs. As an example, the ICCT estimates that an entry-level, gasoline-powered car can achieve better cold-start emissions using a small electric catalyst heater costing an additional €150 (US\$160), while adoption of 48V systems at around €600 can help diesel light vehicles achieve Euro 7 compliance.

## Achieving the right R&D balance

While there is a clear case for continuing to invest in ICE innovations based on regulatory compliance alone, carmakers and their suppliers are severely resource-constrained and must concurrently focus on developing future EV technology and architectures. As a result, industry players are going to have to consolidate efforts around those options that offer the best chance to extend the lifetime of this sunsetting technology. There is no competitive or strategic advantage in developing ICE platforms in-house or in silos. Against this backdrop, we see three strategic directions emerging.

Firstly, carmakers need to seek industry partnerships, even with rivals, so that they can consolidate volumes and spread costs, through shared engine platforms. Offering ICE platforms to other players can help carmakers generate scale through third-party business. This can also be adopted for the ICEs used in hybrid vehicles with

drastically lower numbers of ‘hardware variants’ – referring to powertrain options from which customers can choose.

Eventually, this can lead to ‘last man standing’ business models, with a single player taking responsibility for innovations and development of the engines and becoming the preferred supplier for multiple carmakers. One global engine manufacturer is already adopting such an approach in the commercial vehicle sector. Specialised investment funds could potentially be enticed to finance such business models.

Secondly, carmakers can shift the locus of innovation with countries like China or India becoming the new epicentre of ICE innovation. Several major carmakers already have extensive R&D presence in these countries to leverage their abundant engineering talent base.

## Emerging markets and new entrants

Markets outside Europe and North America account for about two-thirds of annual global automotive sales but may need longer times to transition fully to zero-emission vehicles. Although China has been aggressive on EV adoption, carmakers there are also developing new ICE platforms.

Limited or delayed emissions regulation in parts of Asia and Africa—with Thailand and South Africa two examples—necessitates considering new plant locations there, while the South American market could potentially focus more on biofuels. Shifting the epicentre of ICE innovation would help

carmakers address this demand over the long term.

Finally, a shift is already evident in the powertrain strategies of several carmakers. While new entrants are focusing primarily on pure electric or hybrid vehicles, some of the smaller carmakers in Europe with modest sales volumes have taken bold decisions to fully electrify their portfolio much earlier. A potential, albeit risky, alternative for others could be to switch to more nascent technologies like e-fuels or hydrogen-powered ICEs

## While waiting for the future

While it is increasingly evident that battery-powered EVs will be the dominant powertrain technology for light vehicle segment in the future, that future has not yet arrived. Automobile manufacturing is currently in a transition period in which ICE and EV must coexist.

Given that there is little chance we can skip this step, a forced and premature stop in ICE R&D could undermine what the global economy is trying to achieve through a switch to electrification. To help the industry make it through the transition, more clarity and stability in regulation is needed, with clear, reliable, and realistic timelines on ICE phaseout and emission reduction. A good case in point would be the Euro 7 targets and timeline.

This will allow automakers to leverage as much new technology as possible to make internal combustion less of a burden on the environment and more of a plus for the auto industry and its customers.

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*About the authors: Simon Schnurrer is a partner and automotive expert at Oliver Wyman, based in Frankfurt. Srinath Rengarajan and Thomas Schiel are automotive experts at Oliver Wyman, based in Munich*

# Are open-source patent portfolios the key to the EV revolution?

While Tesla and Toyota opened up thousands of electrification patents to other players, the devil is in the details. By Matthew Jones

**T**he widespread rollout of electric vehicles (EVs) is viewed as a crucial part of the UK's green revolution.

When discussing how this can be achieved, charging infrastructure is often cited as the key to ensuring the appeal and accessibility of EVs to the mass consumer market. This was highlighted by UK Prime Minister Boris Johnson's announcement in November of last year, where he declared the "electric vehicle revolution," which would involve installing 145,000 extra charge points by 2030. The argument is that the wider availability of charging points would increase consumer certainty, and thus increase the demand for

EVs. Inevitably, such confidence in the market would lead to a greater stream of innovators wanting their share of it.

However, the impact of 'open-source' patent portfolios in accelerating the EV industry has often been overlooked. Both Tesla and Toyota took the decision to open-source their patents respectively, claiming the decision was made to remove barriers, spark greater innovation within the EV industry and ultimately open up the road to sustainability. How have these actions impacted the industry, and could open-source patent portfolios prove key to driving greater expansion of the EV market?





## What are open-source patents?

Open-source patents are a method of combining traditional patents and open-source models.

A patent is a type of intellectual property that gives its owner the legal right to exclude others from making, using, or selling an invention for a limited period of time in exchange for publishing an enabling disclosure of the invention. By deciding to open-source patents, the patent owners are ostensibly allowing third parties to use such patented technologies at no cost. Depending upon the terms on which

the patentees choose to ‘open-source’ their patent rights (of which more later), the patentees will have made a commitment not to sue any people working the patented inventions and third parties therefore won’t be in danger of any legal proceeding. The move is often driven by the desire for greater collaboration between companies to develop future technology at speed.

## Tesla and Toyota

In the now famous blog post, Elon Musk announced in 2014 [“All Our Patent Are Belong To You”](#). He explained the decision was made in

### **Patent Pledge**

On June 12, 2014, Tesla announced that it will not initiate patent lawsuits against anyone who, in good faith, wants to use its technology. Tesla was created to accelerate the advent of sustainable transport, and this policy is intended to encourage the advancement of a common, rapidly-evolving platform for electric vehicles, thereby benefiting Tesla, other companies making electric vehicles, and the world. These guidelines provide further detail as to how we are implementing this policy.

### **Tesla's Pledge**

Tesla irrevocably pledges that it will not initiate a lawsuit against any party for infringing a Tesla Patent through activity relating to electric vehicles or related equipment for so long as such party is acting in good faith. Key terms of the Pledge are explained below.

Tesla's Patent Pledge

the spirit of innovation within the industry and the advancement of electric vehicle technology, through removing the roadblocks of intellectual property.

Five years later, Toyota similarly announced that it would allow other companies to use nearly 24,000 patents related to its hybrid car technology, which would be available to license for royalty-free use until 2030, and Toyota will also offer consultation services for a fee. Again, this was motivated by increasing the speed of the transition from fossil fuelled cars to EVs.

The actions by top brands and innovators within the industry have two significant implications, in theory. To those looking to enter the market, being able to borrow from the industry-leading technology that both Toyota and Tesla have developed has the potential to provide a head start to research and development, providing

an initial foundation from which to work. In turn, by helping potential competitors Toyota and Tesla are speeding up the process of innovation and increasing consumer choice, which should have long-term benefits to the buyer.

Therefore, in theory, the open-source patent pledges are incredibly useful for new businesses looking to enter the EV market. However, those who are looking to take Toyota or Tesla up on the offers must make some important considerations before doing so.

### **As simple as it seems?**

From a glance, such moves from Tesla and Toyota significantly simplify the patent process. However, upon closer investigation of the conditions attached, to the extent that those conditions are publicly available, it is possible that they render these pledges open-source in name only.

For Tesla, the Patent Pledge states that the company “will not initiate a lawsuit against any party for infringing a Tesla Patent through activity relating to EVs or related equipment for so long as such party is acting in good faith.” In explanation of this point, it explains that a party is not acting in good faith if they:

- asserted, helped others assert, or had a financial stake in any assertion of (i) any patent or other intellectual property right against Tesla or (ii) any patent right against a third party for its use of technologies relating to EVs or related equipment;
- challenged, helped others challenge, or had a financial stake in any challenge to any Tesla patent; or
- marketed or sold any knock-off product (e.g., a product created by imitating or copying the design or appearance of a Tesla product or which suggests an association with or endorsement by Tesla) or provided any material assistance to another party doing so.

The first point illustrates the substantial risk that could come to companies who choose to take Tesla up on its Patent Pledge offer. The condition could stop any party that’s using Tesla’s patents from suing Tesla for any suspected infringement of their own IP rights (and not just patents). Similarly, the use of the colloquial term ‘knock-off’ could leave companies vulnerable to future litigation, meaning a company using Tesla’s patented technology must be careful in the product design to ensure

that Tesla cannot suggest it is a knock-off. Thus, some would say that Tesla’s conditions illustrate they have not given away any of the company’s patents “for free”. Rather, they gave up some rights to enforce them, and in return expected the same from their competitors.

To find out the details of Toyota’s conditions, those interested must contact the company directly to discuss specific licensing terms and conditions. Thus, it is difficult to make any judgements on the offer.

## All about the small print

Whilst there are clear PR benefits, it is hard to judge the real impact of Toyota and Tesla’s decisions but accelerating the growth of the EV industry certainly seems to be their aim.

However, despite Tesla making the announcement eight years ago, there has been speculation that there is actually little evidence that any major automakers have used the technology the company developed.

Furthermore, while Toyota followed a similar path, the fact that other dominant players in the industry have not followed suit would suggest that is unlikely to become a wider trend in the industry.

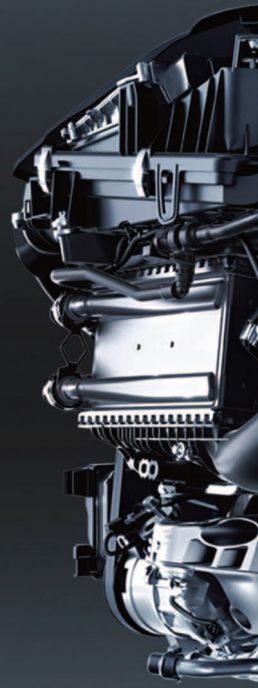
A clear takeaway from Tesla’s pledge is that companies that may wish to use similar open-source opportunities in the future must be careful to consider the small print, and the potential implications for the protection of their own technological developments in the future.

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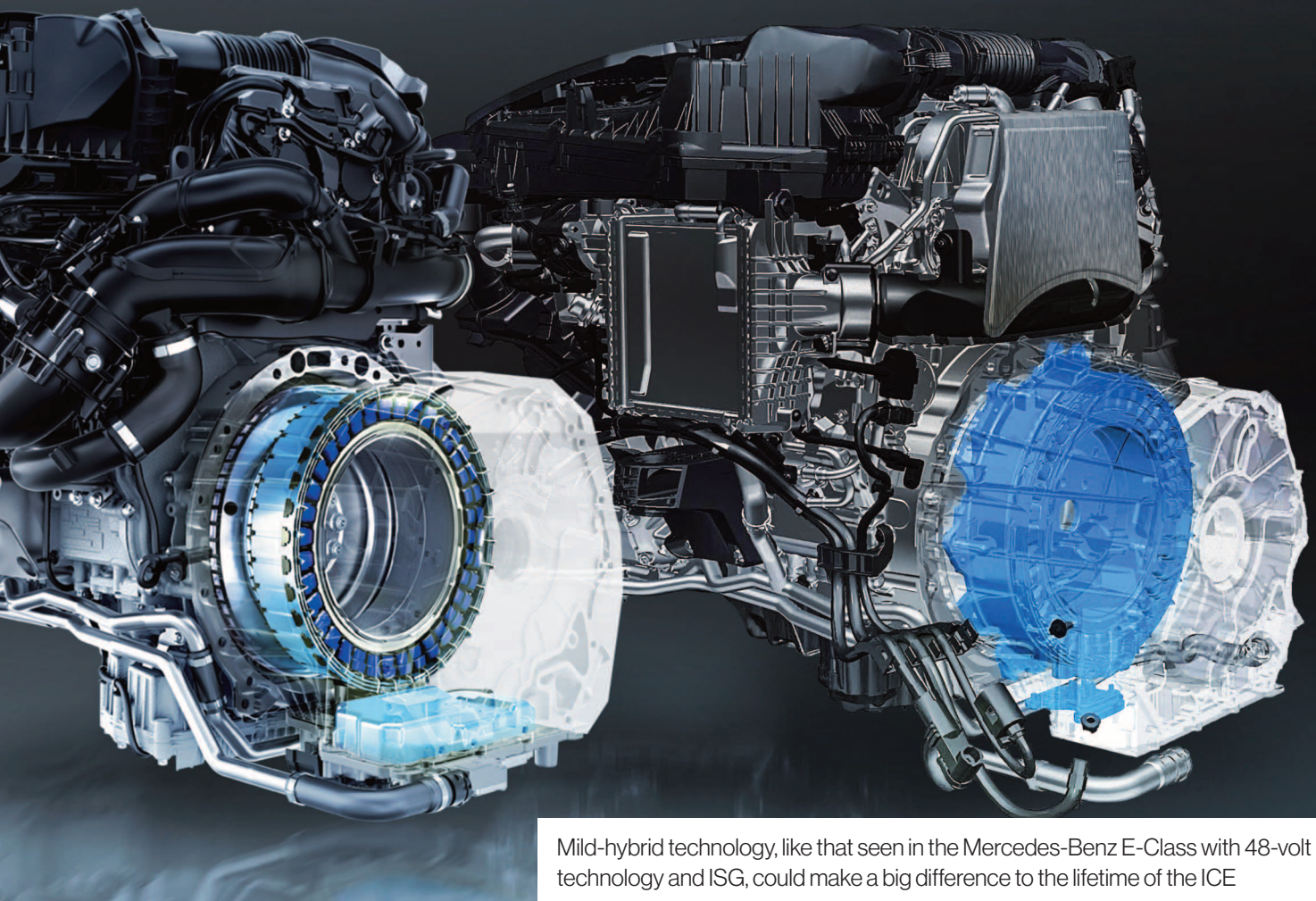
*About the author: Matthew Jones is Partner and solicitor at the intellectual law firm EIP*

# Internal combustion engine improvements could prove more beneficial than EVs, in the near term

**There is plenty still to do to improve ICE technology but inherent limitations restrict its long-term outlook, writes Megan Lampinen**







Mild-hybrid technology, like that seen in the Mercedes-Benz E-Class with 48-volt technology and ISG, could make a big difference to the lifetime of the ICE

© Mercedes-Benz

**I**nternal combustion engines (ICE) have fallen out of the spotlight in recent years as more industry players turn to battery electric propulsion. But that does not necessarily mean the ICE's days are over. According to recent research from Roush, a combination of engine improvements combined with improved mild hybrids could reduce CO<sub>2</sub> by more than 30% and boost fuel consumption by more than 40% compared to a current turbocharged engine—all from technology available on the market today.

## Today's innovation scene

“There is a lot that can be done with ICE and more is still coming,” asserts John German, the US co-lead of the International Council on Clean Transportation (ICCT). As for currently available tools that could be made better use of, the Roush report specifically flagged higher compression ratios, lower bore-stroke ratios on the pistons and crankshaft, increased cooled exhaust gas, variable geometry turbochargers, electricity-

assisted turbochargers, advanced cylinder activation, electrical accessories, and an improved mild hybrid system.

Today's mild hybrids generally put the motor on a belt connected to the engine, but that's not the most efficient approach. German points out that placing the motor between the engine and the transmission with clutches on each side could double the efficiency of the system and allow higher motor power, which will provide some additional incremental efficiency benefits. Mercedes-Benz is taking this approach, but it is in the minority.

the amount of cooled exhaust gas circulation and combustion stability. Roush suggests that another 5% to 10% efficiency improvement is possible with pilot injection.

There are also high-energy ignition systems that could improve combustion, offering a potential additional 5% to 10% benefit, although German cautions that some of that might be synergistic with the pilot injection. "There are indeed some future improvements that aren't in production yet that are also possible with some more innovation," he emphasises.

The industry approach so far has been scattered. Toyota has a high compression ratio engine with cooled exhaust gas recirculation and Mazda has a high compression ratio engine with cylinder deactivation. Putting them together is both technically possible and promising, but nobody has pursued both. As German emphasises, "It's the combination of the technologies that hasn't happened yet."

## **Long-term limits but near-term potential**

While the Roush report highlight some of the innovation going on around ICE technology, these may not be enough to extend its time on the market. That's down to the system's inherent limitations. As German explains, "The maximum efficiency for a standard run of the mill ICE engine is maybe 35%. There are ways to get that up to 45%, which is almost a one-third improvement. But the ICE engine is inherently limited in its efficiency; it's never going to be a long-term solution."

The Roush report also flagged some more advanced innovations coming up, including more widespread use of pilot fuel injection. This has been used in diesels, where a little bit of early fuel injection can significantly improve

“

The ICE engine is inherently limited in its efficiency; it's never going to be a long-term solution



© Mazda

He sticks to this assertion, even with the possibility of using hydrogen in ICE engines for a zero-emission result. “The overall efficiency of that compared to using a fuel cell is really bad,” he points out, as have others. “The primary problem is not the cost of the fuel cell system itself but the cost of the hydrogen. If you’re running it through an engine which has lower efficiency, you need more hydrogen and you’re just exacerbating the biggest challenge for hydrogen in fuel cells.”

Just how long ICEs can meet government targets will vary regionally and depends on just how strict those targets are. In the near term, they could prove more beneficial than EVs. “Looking out to 2030 or 2035, you can get more CO<sub>2</sub> reductions from a focus on ICE than

you can on battery electric, just because there’s only so fast you can ramp up EV sales due to customer acceptance and material availability,” says German.

However, automakers may be reluctant to invest in conventional ICE technology, given the huge sums they are investing in EVs. “That’s the biggest issue here,” he suggests. Provided there was a concerted push on standards, German believes the market could witness “transformational changes of all ICE engines in five to ten years. In the short run you can get more CO<sub>2</sub> reductions than you can from pushing EVs. Then of course you hit a wall on ICE.” In the long run, he sees an inevitable transition to EVs, including both battery electric and fuel cells.

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*About the authors: Simon Schnurrer is a partner and automotive expert at Oliver Wyman, based in Frankfurt. Srinath Rengarajan and Thomas Schiel are automotive experts at Oliver Wyman, based in Munich.*

# Dynamic wireless power transfer in the spotlight at Arena of the Future

Some big name players are showing interest in alternative charging solutions. Simon Heptinstall reports back on the latest at the Arena del Futuro circuit



**I**t was an unlikely vehicle to demonstrate what could be a groundbreaking moment in the history of transport. The car chosen to cruise along the tarmac road at motorway speed without drama was a humble Fiat 500. Nevertheless, the assembled scientists and company executives seemed delighted as the small Italian supermini completed circuit after circuit of the small arena. The Fiat 500e is the new electric version that presumably the manufacturer wanted to promote to the world's media, but the really exciting technology that was being shown was far more significant.

Yes, the car was driving on electric power—but not from its batteries. The power was being picked up wirelessly from cables buried under the road surface.

This 'Dynamic Wireless Power Transfer' system is hugely important for the electric vehicle (EV) industry. It opens the possibility of unlimited range for EVs and removes the need for installing a cumbersome static charging network. It even makes recent progress in static wireless charging pads seem largely redundant.

The Fiat was able to drive apparently forever, without using the power stored in its batteries. These could be held in reserve for driving on roads without the underground charging network. The showcase was held at the Arena del Futuro in Brescia, in Northern Italy. Car conglomerate Stellantis made much of the tests at its new test track modestly named 'The Track of the Future', putting out global press releases and videos.

"Our long-term strategic plan, Dare Forward 2030, is based on the premise of bringing 'cutting-edge freedom of mobility' to all and this project is the very essence of where we're headed as a company," said Anne-Lise Richard, Head of Global e-Mobility Business Unit at Stellantis. "Working with this incredible group of partners, we have proven that inductive recharging technology can power our electrified future. These joint projects are exciting steps as we work to achieve longer battery lifespan, lower range anxiety, greater energy efficiency, smaller battery size, outstanding performance and lower weight and cost."

There was similar positivity from the other companies involved in the project, including the chemical group Mapei, bus-builder Iveco, FIAMM power storage specialists, ABB digital technology group and various university research teams.

While the little Fiat showed the potential of the Electreon system for ordinary motorists, an Iveco bus did the same circuit, demonstrating how public transport can use it. Iveco say the 75kW motor in the 12-metre single-decker bus was continually charged as it drove the road at more than 70kph (43mph). Domenico Nucera, President of Iveco Group's Bus Business Unit, said: "Induction charging technology could become an effective infrastructure platform for all e-mobility systems. We will continue testing in the belief that this technology can effectively contribute to the transition to zero-emission mobility thanks to the benefits it offers to all users."



Time magazine cited the in-road inductive charging system behind "Arena del Futuro" as one of the 100 most important inventions of 2021

## Paving the road to an electric future

Central to the Arena del Futuro demonstration however was a small Israeli operation called Electreon. This innovative eco-technology company is based in the small coastal town of Beit Yannai and has just 80 employees in its latest figures. The company joined the chorus of celebrating the "successful and exciting results".

"This technology may power our electrified future," it claimed. But Electreon Product Manager Itai Koren tackled more practical details after the demonstration. "People want to know if the electromagnetic radiation is safe," he said. "Yes it is. The system is designed in such a way as to minimise

the radiation both inside and outside the vehicle. It was concluded that the radiation is way below the standard requirements."

And Electreon has been working quietly behind the scenes on similar projects in other western countries. Three years ago it helped set up a 'Smartroad' on the Swedish island of Gotland. The wirelessly charging airport shuttle bus is already running passengers 1.6km into the island capital Visby using an underground charging network.

Swedish government officials are impressed and there is serious talk about extending dynamic charging on to mainland roads. Jan Pettersson, from the Swedish Transport Administration recently said openly:

“We are looking forward to spreading the knowledge from the project more widely.” The Gotland project is currently being extended to further study the durability of the road surface under heavy use and how easy it is to increase the power capacity of the system.

Interestingly, Electreon is also experimenting with an automatic billing system in Gotland. More than any technical feature this could ignite the blue touchpaper for such systems worldwide. If public bodies and corporations see the way profits can be clocked up from subscribers to automatic road wireless charging they could soon be rushing to grab a slice of the action.

Meanwhile Electreon’s project to power a public bus system at Karlsruhe harbour in Germany is also expanding after a 100-meter stretch was shown to have worked successfully with a range of EVs: a bus, van, truck and various cars. The next stage is proceeding by extending the road system by half a kilometre into the city centre.

Results like these have helped Electreon win an important contract this spring to build the first Electric Road System in the US—appropriately in the home of the Big Three of gas-guzzling American motoring history, Michigan.

The key to the Dynamic Wireless Power Transfer is a power rail buried under the tarmac. Conductor loops transmit the energy via induction to a simple receiver plate bolted to the underneath of the car. Engineers involved say all the processes are simple: the vehicle’s pick-up system can be fitted in minutes and a road can be given the power rail with a small



Iveco contributed to the project with a 12-metre electric E-WAY, retrofitted with connectivity and recharging technology

team in a couple of days. Electreon makes it sound very simple: “The Electric Road System is fast to deploy. We place our unique copper coils just below the surface of the road. Deployment takes place at night to minimise disruption. The coils are then covered with asphalt and the Electric Road is ready to begin charging EVs.”

On a technical note, the electrical current used for the system is DC as it allows the system to use thinner, cheaper aluminium cables. Interestingly it also means a direct link to solar or other alternative energy sources could be direct. It would not require conversion to AC.

The world saw an ordinary family car and a passenger bus using the wireless charging system. Next up for a track demo at Arena del Futuro, says Stellantis, is an electric Maserati. Presumably the forthcoming videos and releases from the car maker will aim to add a little glamour to what is already a promising hint of the future of EV charging.



© Lightyear

# **Solar-powered vehicles will transform EV infrastructure**

**Will Girling explores Asia's three largest car markets to determine whether solar-powered EVs could solve charging infrastructure challenges**



**A**s electric vehicle (EV) uptake continues to gain momentum in the Asia-Pacific (APAC) region, a pertinent question arises: is local infrastructure being adequately updated to meet demand?

## A variable problem

In 2020, China installed over 284,000 charging points, a figure greater than the US' entire network, which, as of 2022, currently stands at 113,600 nationwide. It seems reasonable to conclude that this large investment is in anticipation of fulfilling the Chinese government's goal of making EVs 40% of the country's total cars sold by 2030. According to Statista, 2.9 million EVs were sold in 2021, representing 15% of total car sales. Clearly, scaling up infrastructure is the name of the game.

India, despite being the fifth-largest automotive market in the world, is still heavily reliant on internal combustion engine (ICE) vehicles—only 1.6% of car sales are EVs. Regardless, the Council on Energy, Environment and Water (CEEW) maintains a buoyant prediction that total sales could reach 43% by 2030. Such growth would require an estimated US\$3bn worth of charging infrastructure development, for which, the CEEW concedes, the presently weak business case would need to be improved.

Meanwhile, Japan seems to have the opposite problem. With EV penetration sitting at 1%—well below the global average of 4%—*Bloomberg* reported in August 2021 that many of the country's approximately 30,000 charge points are sitting unused and rapidly aging. The initial surge in numbers began in 2012 following

almost US\$1bn of government subsidies, with an ultimate goal of 150,000 total by 2030. However, domestic consumer trends are yet to vindicate this highly ambitious target.

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The initial surge in [Japanese charging point] numbers began in 2012 following almost US\$1bn of government subsidies, with an ultimate goal of 150,000 total by 2030. However, domestic consumer trends are yet to vindicate this highly ambitious target

## Non-eco-friendly grids

Compounding the problem of solving charging infrastructure is the reality that many power grids are already at risk of becoming strained. Also, if the primary motive for shifting to EVs is for their ecological benefits, placing more emphasis on grids reliant on 'grey power'—electricity generated by fossil fuels—seems counterintuitive.

According to a 2021 report from HSBC, coal-generated electricity presently accounts for 65% of Asia's electricity, rising to 72% in China. Environmental difficulties make alternatives like hydroelectric difficult to realise in some countries, and other forms of



renewable energy are in their developmental infancy. This is likely to change in the 2030s; China is reportedly adding 130GW of renewable energy per year—equivalent to Germany’s entire capacity—and India plans to install 450GW over the next decade. However, in the short-term, automotive companies might find value in exploring more ambitious solutions.

## Circumventing the issue

As previously demonstrated, the difficulties experienced by each country are different, and, in some cases, completely antithetical. Furthermore, outside of infrastructure, the practical challenge of expanding EV penetration is compounded by consumer issues like affordability and practicality. Bypassing both considerations would yield significant long-term potential in transforming EV ownership in

developing markets. One possible solution is the rise of an emerging vehicle category: solar-powered EVs.

Although previously explored by incumbent OEMs such as Toyota in its Prius plug-in hybrid, this example’s solar panel roof only added 44.5km to its range. In 2019, Hanergy Glory’s Chinese K-Car took the concept further by developing an EV capable of lasting 30 days driving a 20km route without needing to recharge. However, as of June 2022, there has been no indication of the project’s progression or refinement.

So, what might the future of solar-powered EVs in Asia look like? A hint comes from Dutch start-up Lightyear, which is determined to transform solar power from a performance enhancer into a practical method of running a vehicle long-term.

With a 60kWh battery, the Lightyear 0 model is more energy efficient (10.5kWh per 100km) and has better

Lightyear's model 0



range (560km) than the Tesla Model 3 (16.1kWh per 100km and 360km respectively). More impressively, based on a 35km commuting route in the Netherlands, the Lightyear 0 was found to last two months between charges. Furthermore, this interval grew to seven months when tested over the same distance in the sunnier climate of Portugal.

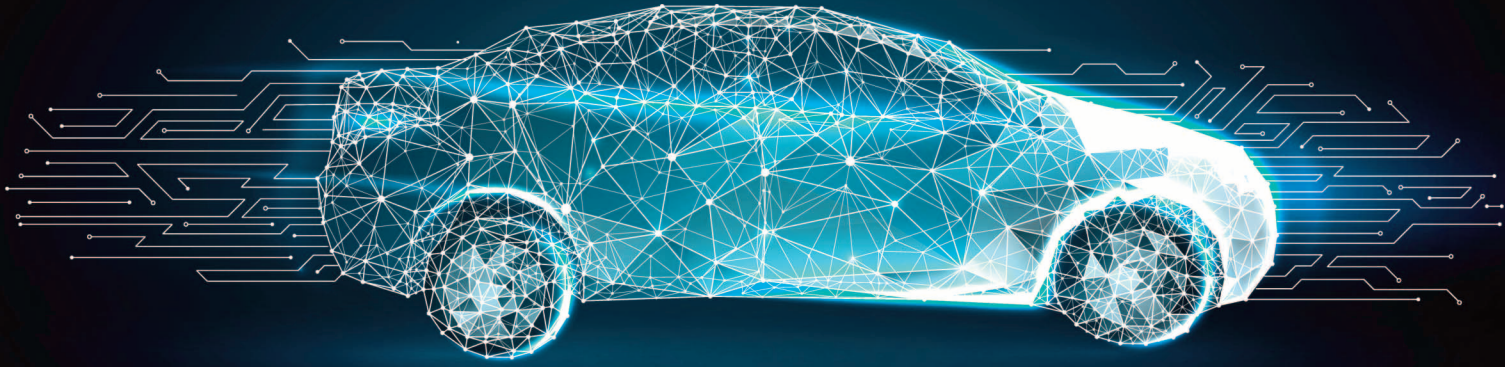
## Scaling the solution

The Lightyear 0 is currently available for pre-order only in the EU, and there are no indications that this will change. Even if it was, there is also a much more glaring issue—one that has impeded EVs generally: affordability. Priced at US\$261,000 and with fewer than 1,000 to be produced, the model is too exclusive to provide a comprehensive answer to APAC's charging infrastructure problem.

Lightyear appears to be aware of this and has announced that its Lightyear 2 model will be released in 2024/25.

Priced at a more moderate US\$30,000, this vehicle apparently demonstrates the company's "mission to make clean mobility available for everyone, everywhere." Although the performance spec of the '2' is yet to be presented, Lightyear believes that, due to the reduced need for charging points, its vehicles "can be adopted worldwide and can scale faster than current EVs." Details on whether this cheaper model will be available for the APAC market remain unconfirmed.

With the Nissan Sakura and Mitsubishi eK X EV already redefining affordability in the Japanese market at sub US\$15,000 prices, and the average price of a new car in India sitting at US\$10,000, the Lightyear 2 might still prove too expensive to solve charging infrastructure issues. However, with governments in APAC demonstrating a clear willingness to subsidise clean energy projects, it is conceivable that domestically produced solar-powered EVs have a larger role to play in the transformation of mobility.



# **Embedded SIMs will simplify the connected vehicle experience**

**Giesecke+Devrient says eSIM tech would allow OEMs to  
enable a more seamless connected experience  
automatically. By Jack Hunsley**

In-vehicle connectivity has quickly transitioned from a creature comfort to an expected standard fitment in the automotive industry. As such, any expertise in enabling an enjoyable and seamless in-vehicle connected experience is now highly valued by automakers, which are eager to make the most of the latest connected tech innovation.

## Simple yet effective

Viewing the vehicle as an IoT device in its own right could be one way of enabling satisfactory future connected vehicle experiences. One proponent of this thinking is Giesecke+Devrient (G+D). Based out of Munich, Germany, G+D is well-versed in numerous IoT verticals, with the company developing technology for secure car connectivity since 2012.

One of its most recent automotive-focused innovations is its Dual-SIM Dual-Active (DSDA) solution. DSDA sees vehicles equipped with two embedded SIMs (eSIM), one to be used for vehicle services such as eCall, navigation or traffic information and the second for the driver's private information and in-vehicle entertainment services. As Soenke Schroeder, Director Global Product Marketing and Innovations at G+D, told *Automotive World*, the goal is to create a smoother in-vehicle experience for users.

“For many years now the amount of data being generated by and flowing to cars has been increasing, especially given innovations in connected

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In-vehicle connectivity has quickly transitioned from a creature comfort to an expected standard fitment

services and autonomous driving,” he said. “At the same time people in our digital society are consuming more and more data with their smart devices and they now want to use that data in-vehicle. The result is that more automakers have decided that two independent eSIMs is the way to go.”

Integrating not one but two eSIMs brings a couple of key benefits. First, by running two eSIMs automakers have the option to split connected responsibilities between the two eSIMs. This can help ensure all services run more smoothly and more reliable, with bandwidth divided more evenly. The second benefit centres around the consumer's additional connected needs. For instance, as Schroeder explained, a key selling point for OEMs is the potential to move past Bluetooth technology.



Can eSIM tech help automakers provide more seamless connected experiences?

Though a common sight in practically all modern vehicles, Bluetooth can be a problematic technology to include.

“It is not uncommon for users to have issues connecting their phone to the car via Bluetooth as not all mobile devices are 100% compatible and not all cars are either,” he said. “The knock-on effect is that automakers must conduct many tests to ensure their Bluetooth system works as expected. This is a huge effort. A Bluetooth connection could also be a gateway for malware in both directions.”

Installing an eSIM instead removes this hassle. Rather than relying on Bluetooth, the connection from phone to car is instead run via the eSIM. “The advantage of DSDA is that the phone SIM can be activated automatically

when the driver enters the car,” added Schroeder. “When you enter your car, your car becomes an extension of your mobile phone, similar to how any wearable smart devices do when activated. You can continue seamlessly with your calls and using your mobile infotainment services—such as music and video streaming.”

## Easy installation

G+D is confident the setup will offer manufacturers and consumers greater flexibility. For the former, Schroeder stressed that it is not too complex to install DSDA in a completely new model. On the consumer side, he added that owners can have up to six different profiles in one car, allowing multiple occupants to easily transmit their connected lives into their vehicle.



To drive even greater levels of flexibility, G+D also offers secure eSIM management (subscription management). In practice, this allows the vehicle's eSIMs to switch between different network operators, a difficult task given that these embedded SIMs are soldered into the vehicle. "If you've been a T-Mobile customer, for instance, for two years but then plug in a card from Vodafone into your phone, your phone switches seamlessly to the new network," said Schroeder. "For cars and IoT devices this is much more difficult - so with eSIM management, device makers and car OEMs can remotely switch networks easily without exchanging the SIM or eSIM - for its complete lifecycle."

## Future SIM technology

DSDA is already drawing good attention from automakers. For instance, in February 2022 G+D announced that DSDA will be integrated into upcoming BMW models including the already released iX and i4. This builds on a partnership

between the two companies that has run since 2018.

"Today's drivers have different expectations of a car than in the past," said G+D Mobile Security's Chief Executive, Carsten Ahrens, on the announcement. "We are pleased that G+D has been the solution partner for the BMW Group in the area of eSIM for many years, and now also for the new DSDA solution. Together, we are creating the basic requirement for a new kind of individually networked mobility." Schroeder added that G+D is also in talks with other as-of-yet unnamed OEMs to install DSDA in their vehicles too.

As for where G+D sees automotive SIM technology moving, Schroeder suggested that there's growing interest in integrating even smaller integrated SIM cards. G+D's current eSIM measures five by six millimetres, but there could be scope to have integrated SIM cards that are smaller than a square millimetre. However, for the time being, G+D is firmly focused on pushing DSDA out into the market. "The dream is for DSDA to be in every car," Schroeder added.



# Where next for location data?

**HERE shares its vision for the role of location intelligence within the mobility and logistics industries. By Megan Lampinen**





**T**he digital revolution is reshaping the automotive industry, turning vehicle manufacturers into smart mobility providers. Data is at the heart of this emerging ecosystem, and location-based data in particular is paving the way for new services and capabilities. Nobody does location data like HERE Technologies.

The company was recently recognised as the top ranked location platform by industry analysts at Strategy Analytics. Today there are about 150 million vehicles across more than 50 automotive brands with HERE data and solutions on board. The company's real-time traffic data, hazard warning and other vehicle services are drawing on input from more than 34 million connected vehicle. Those services, and the vehicles powering them, are poised for considerable growth in the years ahead.

Niko Boeker, Senior Manager of Industry Solutions Automotive at HERE, closely monitors market trends to pinpoint areas of overlap with the company's own capabilities and portfolio. The aim is to spot potential growth opportunities as well as gaps in the market. While HERE's data and the use cases it supports have soared over the past few years, the momentum shows no signs of slowing.

### **Everyone is talking about the software-defined vehicle. What does that mean for HERE?**

By definition, a shift towards software-defined means a complete paradigm shift and rethinking on the automotive OEM side. Automakers are well known for their expertise at bending metal. This kind of hardware engineering will

remain relevant, but it becomes challenged by new requirements around software. The software-defined vehicle will be defined by the quality and capabilities of its software stack and the compute platform underneath it. With this coming change, companies like HERE can benefit from more open sourcing and new opportunities to participate in more of the software stack.

### **Broadly speaking, what does that mean for the value chain?**

Automakers are ramping up capabilities in-house to capture more of the emerging value chain. Their profit margins are already extremely thin, and everyone is hoping to see that change as they become stronger in the software department. At the same time, we see the decoupling of application software from computing platforms with the focus on faster innovation cycles and time to market. Over-the-air (OTA) updates hold the promise of being able to update and upgrade systems, vehicles, and user experiences at any given time throughout the entire life cycle of the vehicle.

### **Where do location services fit into this new digital ecosystem?**

Location is core in realising many of the services that are meant to bring in new revenue streams in the future. The navigation use case is one that's very much a commodity and simply expected. However, if you combine that with aspects of driver safety and semi-automated driving, it becomes extremely relevant for you to locate yourself, to get an understanding of what the vehicle perceives and where it's headed. Beyond that, it's about having reassurance that the vehicle



HERE powers BMW's Connected Navigation Services with real-time traffic information

has additional levels of redundancy built into it when location is acting as another input compared to sensor-only automated driving systems.

**Some automakers may claim there is no need for a map to create a top-notch driving experience or facilitate automated driving. What's your response to that?**

We know that there are some hardcore players claiming that, including Tesla. For us, there's very little doubt that this is extremely relevant. The map is basically another sensor built into the vehicle, a key to delivering the kind of systems that are needed. There are many services that rely on location data and location insights, like in-car advertising and commerce. While you're on the go you want to know

what's along your route, so it's extremely relevant.

**With the move to software-defined vehicles, should we expect to see an acceleration of next-generation digital cockpits?**

For sure. This market is driven by the end consumer. Shoppers today expect a 'wow' factor. A digital cockpit that goes wider than just the infotainment screen is one aspect that plays a role here. This is linked to the software-defined vehicle, and the architectures that are moving towards more standardised platforms will facilitate much of this and lead to more scalability. They will make it more attractive for players to enter that space and look for solutions that can be reused for other OEMs.

## What expectations do OEMs have for independent software vendors in this environment?

Their focus is on finding the right partner that is flexible enough to cater to more agile ways of development. There will be more expectations around new business models, as became public recently with Mercedes who strengthened its ties with Nvidia and confirmed mechanisms for revenue share for digital services and features. OEMs have concluded that they can't do everything by themselves; they simply won't be able to hire as many developers as they would like. It's going to be much more about thinking in terms of partnerships rather than the traditional buyer/supplier kind of relationship.

## Why is it important to have homogenous functionality between features like navigation, intelligent speed assistance (ISA) and advanced driver assistance systems (ADAS)?

We have reached the stage where Level 2+ automated driving is becoming much more normal on the production lines. But here, and to some extent even with Level 3, the driver still needs to be alert about what's going on. There also has to be trust that the vehicle knows what the vehicle is doing. The handover situation between vehicle and driver will be built around trust in the vehicle's capabilities, in its visibility. What you see as a driver in your navigation system is extremely relevant in terms of trust, confidence building, and overall user experience.





HERE's location intelligence is being put to work generating data from the warehouse floor. This will enable businesses to make better informed decisions on how they can streamline operations

### **What's the market's perception of head-up display and real-time 3D navigation with augmented reality software maps?**

We are seeing the first real market examples from the likes of Mercedes-Benz, Volkswagen, and Hyundai. It's expensive technology right now, at least if it's something like windscreen projection, but as camera technology and correction becomes better, there's very little doubt that this is the way to go.

### **What's your own experience of this?**

I much prefer to use a HUD for key information relevant for the driving task. I am very much looking forward to also having the additional comfort of an augmented reality overlay that directly guides you through a road network and also indicates certain hazardous situations. That brings much more quality in terms of confident driving. It takes away the need to look at the different screens in the cockpit, which are getting bigger and brighter, and helps drivers keep their eyes on the road while still receiving information that's relevant.



**This tech is still too pricy for most buyers and mass market manufacturers. What’s the outlook on that front?**

With greater market penetration, the cost will decline and eventually this will become a commodity. It starts with the premium brands but already the Volkswagen ID.3 offers a pretty decent experience. That’s probably the lowest segment car to feature this, but I would expect greater market adoption in the western markets in the next three to six years.

**Where does HERE’s data marketplace fit into these wider trends?**

We believe in the relevance of having a unified data source serving all the different automotive use cases. There

has been tremendous momentum with ADAS and ISA, and that points to how the legislation is helping with market adoption. What is really critical from both a user and a sourcing perspective is for OEMs to have this simplified and broken down to one supplier providing the location intelligence and the data needed for those use cases.

That ties into the software-defined vehicle concept, where automakers want to tap into that in a very easy way. These assets already exist today, offered by us, and they don’t need to reinvent the wheel. Almost everything that we have—our APIs, content, software solutions and SDKs—are all fed by and served by our HERE platform. In that sense, it is catering to the connected vehicle today and the software-defined vehicle tomorrow.

The image is a composite. The top half shows several white wind turbines in a field under a clear blue sky. The bottom half shows a close-up of blue solar panels. A dark, semi-transparent rectangular box is overlaid on the middle of the image, containing the main title in white text.

# **Saving the planet: the biggest business opportunity of the century**

**Hexagon is applying its vast information expertise to promote sustainable industry solutions. By Megan Lampinen**

Whether it's chip shortages and net zero targets or the vast investment demands of electrification and autonomous driving, the global automotive industry has its fair share of challenges at the moment. Successfully navigating these increasingly turbulent and unfamiliar waters will require flexibility, creativity and perseverance. In some cases, incumbents may need to reinvent their business model and their product offering. One company believes that the key to thriving could lie in the nature of the challenge itself.

“People face obstacles but can use them to find a way to success,” asserted Ola Rollén, President and Chief Executive of technology

company Hexagon. Addressing thousands of attendees at the HxGN Live 2022 conference in Las Vegas, he quoted Marcus Aurelius, “What stands in the way, becomes the way.”

Hexagon, like many other players involved in the automotive ecosystem, now faces a new era of sustainability and all the pressure that comes with an increasingly green agenda. This is where Aurelius' genius comes in to play. For many companies, tighter emissions requirements and greater sustainability scrutiny have been dampeners of profit, demanding hefty financial investments and restricting growth plans. In this new age, particularly in the hangover of COVID, Hexagon sees the emergence of a new paradigm where sustainability not

**HEXAGON**

## Sustainability impact throughout the value chain

Hexagon addresses environmental and human rights issues throughout its entire value chain. As the production of Hexagon is formed of software development and assembling of components, its greatest sustainability impact lays within its supply chain and the customer use of its products.

Sourcing	Transportation	Production	Customer use	Recycling
<p>Hexagon's sourcing consists predominantly of technology components and server capacity, and thus no resources or raw material is purchased. Hexagon is however exposed to risks related to human rights via its supply chain, and also need to ensure the metals in the components stem from ethical sources.</p> <p><b>How we act</b></p> <ul style="list-style-type: none"> <li>Rigid processes for onboarding of new suppliers, covering human rights and environmental aspects.</li> <li>Conflict minerals policy for sourcing and suppliers.</li> <li>Ongoing supplier audit program.</li> </ul> <p>Negative ESG impact</p>	<p>Hexagon has a worldwide presence with customers in all regions. Transportation of products from production facilities to customers generate indirect emissions through suppliers of transporting services. Hexagon's consultancy and support services also generate travel emissions.</p> <p><b>How we act</b></p> <ul style="list-style-type: none"> <li>Establishing production facilities near suppliers and customers.</li> <li>Sustainability targets for scope 3 emissions.</li> <li>Company car framework to reduce emissions.</li> </ul> <p>Moderately negative ESG impact</p>	<p>Hexagon has no energy or resource intensive production facilities. The production is mainly assembly of components or development of software solutions, limiting the stress on environment and workers.</p> <p><b>How we act</b></p> <ul style="list-style-type: none"> <li>Environmental policy and ISO 14001 certification programme for facilities.</li> <li>Program to increase share of renewables.</li> <li>Sustainability targets for Scope 1 and 2 emissions.</li> </ul> <p>Moderately negative ESG impact</p>	<p>The use of Hexagon products increases efficiency, lowers waste, and supports safety, with huge positive impact. This is where the key positive sustainable impact in Hexagon's value chain takes place.</p> <p><b>How we act</b></p> <ul style="list-style-type: none"> <li>Innovation and R&amp;D focused on solving sustainability challenges of customers.</li> <li>Exploring new opportunities within greentech through new business venture.</li> </ul> <p>Positive ESG impact</p>	<p>When Hexagon's products have reached the end of their life-cycle, they contain metals and technology that should be recycled to avoid negative climate stress.</p> <p><b>How we act</b></p> <ul style="list-style-type: none"> <li>An after-market program where customers can return products to Hexagon for recycling or recalculation.</li> <li>Repurchase program of used equipment for reselling to other markets or industries.</li> </ul> <p>Moderately negative ESG impact</p>

© Hexagon



**Ola Rollén,**  
President and Chief Executive, Hexagon



**Erik Josefsson,**  
CEO, R-evolution

only allows for profitability but even drives it. “The way forward from here is accountability,” Rollén asserts. “Thirty years ago, accountability was in the way of making money and progress. What was in the way has become the way forward.”

## Data as an economic lubricant

In practical terms, that means a host of sustainable innovation and green-technology investment. “In the shift from fossil fuel to renewable fuels we can build a niche that will be very profitable,” Rollén reiterates. Much of this activity is centred in Hexagon’s subsidiary R-evolution, led by Erik Josefsson. One of the big questions steering Josefsson’s strategic vision is “how can we save the planet by putting data to work?”

Hexagon is all about data. Rollén has been leading the company for 22 years, taking it on a radical transformation of acquisition and growth. When he first came on board he infamously described it as “garbage”, but under his watch it has acquired dozens of companies and expanded its capabilities in many key megatrend areas: sensors, software, digital twins, autonomous solutions and vehicle electrification. The common thread here is data.

“We look at data as the lubrication of the global economy,” Rollén told Automotive World. “We will need data to continue to thrive in various industries.” That said, he’s not a fan of the suggestion that data could be the new oil. “It is not data but rather information that will be very powerful,” Rollén clarified. But not all data is created equally, and using or monetising the right data effectively is



a real skill. “Data could be useless or it could be worth billions,” he said. When paired with the green sustainability push, it could become an absolute gold mine.

That green effort includes Hexagon’s involvement in electric vehicle batteries and R-evolution’s investment projects exploring green hydrogen and various forms of renewable energy with solar energy parks. And all of this R&D and investment, while great for the planet, is simultaneously great for business. “We aim to solve depletion and waste challenges in a way that also creates economic value. Saving the planet is the biggest business opportunity of the 21st century,” asserts Josefsson. “In the past year, this mindset has shifted from a handful of ‘save the planet’ demonstrators to a core value shared by everyone. It’s moved from something nice to have to something that is business critical. When something become business critical then you put a lot of money there. When you put money there, with the right solutions you can make a good business out of it.”

Hexagon is positioning itself as the supplier to offer those solutions. Many of these use cases involve a combination of the physical and digital world. “The Metaverse is completely interwoven with our real lives already right now, impacting how we live and work in ways beyond imagining,” says Hexagon’s Chief Technology Officer Burkhard Boeckem. “In this new reality, we have a digital version of ourselves that already exists. We left our digital fingerprints on the Metaverse. Your digital self is shaped by the decisions you make and the work you do in engaging with digital platforms.”

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The Metaverse is completely interwoven with our real lives already right now, impacting how we live and work in ways beyond imagining

Data, if not the Metaverse, is actively at work enhancing sustainable business models. For instance, simulation insights facilitate optimum cooling of R-evolution’s recently acquired solar energy park in Spain. “We combine the physical and digital world to improve efficiency, and we need to look at doing that within green tech specifically,” says Josefsson.

Moving forward, the application of smart data processes and insights will facilitate green, responsible solutions for many of the mobility industry’s current challenges. At least that’s the plan at Hexagon and its various business units and subsidiaries. “There is a new market in saving the planet,” Josefsson asserts. “I am sure that the next big wave will be on the planet saving side.” If the success this group is predicting materialises, it could become a new template for the wider industry.