DVN
Lidar

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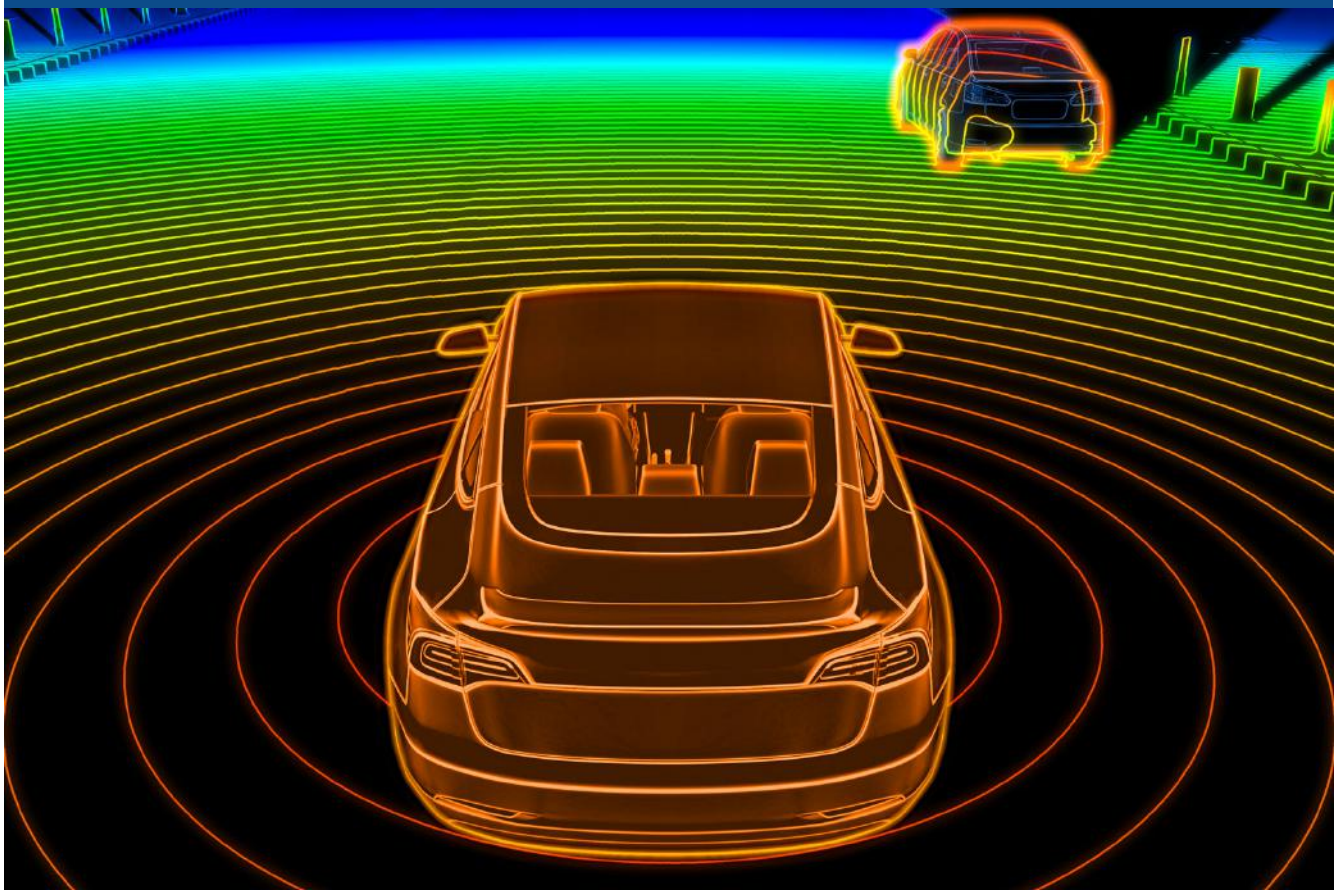


EDITORIAL

Everything's Coming Up Lidar!

This lidar-heavy month might look like the new pace of business as usual in the lidar world. A new L3 system with lidar is coming on the market, with the new BMW 7 Series.

We bring you a DVN-L interview with Cepton, wherein they explain the benefits of lidar integrated behind the windshield and describe their cost-control approach by developing their own ICs.

Chinese premium EV brands continue their expansion; Li Auto wants to become like Tesla with 1.6 million cars in 2025. They're using lidar for L^{2+} applications, which are easier to launch compared to L^{3} systems such as the one on Volvo's EX90. Volvo has announced their EX90 with lidar will not be ready before Q3-2024 in the US.

In lidar technology, the ISO project to develop a test method for automotive lidar will get under way soon—an important step, as international standards are crucial for lidar to be considered a mature, mainstream technology. Today's DIN 41791 standard, published just this past April, is a start, but not enough by itself.

As for AD deployment: robotaxis, delivery shuttles, and autonomous trucks are starting preliminary test operations everywhere—even in the Middle East—but a commercial deployment and profitable business case is still a long way away. Example: Cruise announced a $500m loss in Q1-2023.

Finally, you will find our final agenda for the Lidar Deep Dive III event to be held 29-30 August in San Francisco. This event, combined with a lidar session of the DVN Lighting Workshop, will host 10 lectures about lidar.

We're ever so glad you're here with us in the DVN-Lidar community. Enjoy this newsletter!

Alain Servel

DVN LIDAR ADVISOR

INTERVIEW

DVN-Lidar Interview: Cepton VP Brunno Moretti

Brunno Moretti is VP of Product at Cepton, a leading lidar innovator headquartered in Silicon Valley. Moretti oversees Cepton's ongoing product development to drive business growth across automotive and smart infrastructure markets.

Prior to Cepton, he was the Director of Product Strategy and Business Development for ZF Friedrichshafen. He previously worked at General Motors in a variety of positions, and managed Uber's self-driving business unit as a senior vehicle program manager. Moretti holds Master's degrees from the University of Michigan and the University of Indiana in Energy Systems Engineering and Business Administration, respectively.

DVN: Cepton, founded in 2016, is now close to the start of production for their first customer. Tell us about your company and its history, will you?

Moretti: Cepton was founded by a group of lidar and automotive industry veterans in 2016 to drive the mass-market commercialization of lidar technology. With the vision of enabling safe and autonomous transportation for everyone, we focus on ensuring the safe deployment of next-generation ADAS technologies through the use of high-performance, reliable and cost-effective lidar sensors.

We developed a unique, patented lidar scanning method, called Micro Motion Technology (MMT®), to achieve the optimal balance between performance, reliability and cost. Cepton has been awarded a significant ADAS lidar series production award with Koito on the General Motors business; we are proud that our technology is part of GM's sensor fusion approach to automated driving. Apart from GM, Cepton is also currently engaged with all other Top 10 global OEMs.

In addition to the automotive market, Cepton also has a strong presence across various smart infrastructure markets, including the largest lidar contract in the tolling industry with a leading U.S. tolling system operator. We have been working with over 100 customers and partners on integrating Cepton lidars into smart systems that transform city infrastructure, spaces and industrial applications.

DVN: What have been some of the most exciting developments in your technology and products lately?

Moretti: We keep innovating our technologies to drive continuous improvements of lidar performance while maintaining the optimal combination of size, power consumption, reliability and cost. This year, we announced Vista-X90 Plus and Vista-X120 Plus, featuring ultra-high resolution and a software definable region of interest, while reducing the sensor footprint by up to 58 per cent, and keeping the power consumption exceptionally low.

We have also expanded our leadership at the chip level with our announcement of dedicated back-end point cloud processor ASIC, named Komodo. We've also been using a dedicated front-end signal processor ASIC called Iguana. I believe Cepton is the only lidar company to have developed dedicated ASIC chips for optimized processing capabilities.

DVN: What are your thoughts and preferences on wavelengths and power? What about eye safety?

Moretti: Cepton uses the 905-nm wavelength, as the 905 nm laser technology is mature and already automotive grade. There have long been misconceptions about the eye safety of a lidar purely based on its wavelength choice. Lidar eye safety depends on many factors, including laser wavelength, exposure time, peak power, repetition rate, continuous power, divergence power and pulse width if it's a pulse laser. Cepton lidar sensors are Class-1 eye safe, because in addition to the wavelength, we have also optimized the other aspects of the lidar design to ensure safety, quality and reliability.

Cepton lidars are known within the industry to be power efficient. Our long-range Vista-X90 lidar, which is expected to hit the mass market later this year, consumes under 13W; our near-range Nova lidar for blind spot detection consumes only under 8W.

We do expect to further reduce the power consumption of our lidars. In addition to continuously innovating our imaging technology, we've also focused on utilizing our ASIC chipset to achieve this goal. Compared to FGPAs and merchant silicon devices, ASICs are highly efficient, miniature and low-cost, optimizing signal processing while minimizing power consumption.

DVN: You can support a behind-windshield lidar integration—quite unique today. What are the benefits and constraints of this type of integration? Do you see this position becoming standard in the future?

Moretti: Having the lidar behind the windshield has several benefits, including:

- No need for expensive additional air and water cleaning solutions, as existing wiper systems will address the cleaning needs. Mobileye cameras, for example, have lived in that location for a very long time due to this benefit.
- The height of the mounting location in the vehicle. The higher the lidar is placed in the vehicle, the more it will be able to detect. Putting the lidar behind the windshield gives automakers basically the same height as a roof mount but without the addition of expensive cleaning systems.
- Seamless design. Integration behind the windshield will not disrupt the vehicle design. It is an elegant way to hide the sensor and not interfere with vehicle exterior features.

As for constraints, there is a very small percentage loss in performance in terms of range, but it can be compensated. We work with all of the top tier-1 glass suppliers in the industry to ensure the best transmissivity possible for lidars placed behind the windshield.

Yes, we see integration behind the windshield as a potential future standard due to all the benefits listed above and very few drawbacks. We have had tremendous interest from automakers who are aware that Cepton is the only lidar company going to production with a lidar behind the windshield through our flagship ADAS lidar program.

DVN: How does your lidar perform in bad weather conditions compared to a camera or a radar?

Moretti: Our lidar performs very well. We have proprietary methods to classify weather, be it snow, rain or fog, and allow our customers to decide if they want to filter those points out or flag them as weather points.

As many may know, water absorbs light at certain wavelengths, and 1550 nm happens to be closer to the absorption peak of water compared to 905 nm. Consequently, 905-nm lidars are advantageous when dealing with rain and wet surfaces. Therefore, our lidars are very well suited for use under bad weather conditions.

DVN : Tell us about your short-range lidars and their ADAS applications.

Moretti: We have a near-range lidar called Nova. It is a very small and capable sensor that can be used for several different ADAS use cases. It provides the capability to give 360-degree coverage around the vehicle without disrupting the vehicle design. Here are some examples:

- Autonomous L^4 parking features
- Turning scenarios where the main lidar cannot cover the vehicle's blind spots, for example, below the side windows or immediately in front of the vehicle
- Autonomous trailering capabilities for pickup trucks and semi-trucks, such as autonomous hitching, trailer sway detection, jackknife prevention and truck bed content security
- Near-range detection around a semi-truck's cabin and cargo.

To be easily and seamlessly embedded around a vehicle and create a virtual 'safety belt', the near-range lidar must be extremely compact and power-efficient, while still maintaining high performance. Cepton's Nova lidar has achieved a good balance between these factors and has been welcomed by many automotive customers since its introduction.

DVN: You've announced a win at GM. Can you tell us how that was achieved?

Moretti: Cepton's journey to success began years before our public disclosure of the series production award from GM in 2021. In a highly competitive arena of 30-40 lidar companies, it took almost two years to validate and narrow down the top contenders. Cepton emerged as the winner due to our cutting-edge Micro Motion Technology, which combines what matters most to automakers: performance, cost and reliability.

From the initial design win to the development of A, B, and C samples, the entire process took approximately 2½ years. This journey highlights that winning a design competition is just the first step, and the path to bringing a product to market demands substantial time and commitment.

DVN: Will FMCW technology be coming soon? What would be its benefits?

Moretti: I believe that FMCW does have some benefits, such as instantaneous velocity, but that is something ToF lidar can also deliver in other ways. The main issue we see with FMCW is the complexity of signal processing: due to the continuous-wave nature of the sensor. Data processing and interpretation can be more challenging, requiring sophisticated algorithms and more compute power, which equates to higher cost. The requirement for coherent optical sources and complex modulation schemes can also add to the overall system cost.

DVN: Are lidar and imaging radar competing or complementary? And do you foresee the radar-lidar gap narrowing in term of performance and cost?

Moretti: I believe lidar and imaging radar are highly complementary technologies. Both have their distinct benefits and downsides, but in order to have the safest possible ADAS platform, it is essential for perception systems to integrate camera, lidar and imaging radar. However, considering the limitations imposed by physics as well as by the regulating bodies on which frequencies can be used, I don't anticipate imaging radar catching up with lidar anytime soon in performance.

DVN: How is the automotive lidar market developing around the world? What's driving it?

Moretti: We see strong demand in North America, Europe, and Japan. China's market has been dominated by the Chinese lidar companies, and Cepton made a conscious choice to not engage there due to concerns over intellectual property.

I believe autonomous driving served as a catalyst for the inception of today's lidar industry and landscape, encouraging the emergence of new companies and technologies. However, it will be ADAS (L^2, L^3) that will drive the most significant growth for lidar. Once more ADAS features like Ultra Cruise are deployed on the roads, autonomous driving companies will reap the benefits of cheaper economies of scale. We have already observed a shift from autonomous driving companies using spinner lidar to directional lidar, indicating their progress towards commercializing their technology.

LIDAR BUSINESS

Lidar Business News

In the first half of 2023, **Li Auto** delivered a total of 139,117 new vehicles to customers and surpassed 30,000 units for the first time in June. Looking ahead to the second half of this year, they aim for a monthly delivery target of 40,000 units in the fourth quarter, relying on their L-series products. Li Auto's ambition is to become the top-selling luxury brand in the Chinese market, with a target of 1.6 million vehicles by 2025.

Starting June 28, the **Geely Zeekr** 001 coupé and X SUV officially opened for pre-orders in Europe. In the European market, the 001 starts at €59,490, while the X starts at €44,990. The new vehicles will go on sale in Sweden and the Netherlands first.

The **Volvo EX90 launch has been delayed** by five or six months on software integration issues. U.S. deliveries are expected to begin in the third quarter of 2024. Volvo Cars CEO Jim Rowan pinned the delay on the **complexity of the software code around the EX90's lidar system**. The EX90 won't drive itself at launch, but autonomy will come later with a software update.

Hesai Technology will supply lidar units for OE installation on several upcoming SAIC commercial vehicle models. The vehicles will feature Hesai's AT128, a leading-edge, automotive-grade, ultra-high resolution long-range lidar. It's a key milestone in Hesai's strategic collaboration with SAIC Commercial Vehicle Division and Utopilot to advance intelligent driving technologies.

Innoviz and **Loxo are stepping up their partnership** to utilize InnovizOne lidar technology in Loxo's zero-emission delivery vehicles. This technology advancement aids the sustainable transport of goods from local distribution hubs to consumers.

Horizon Robotics, a Chinese automotive computing solution provider, announced a strategic **partnership agreement with Aptiv**. Horizon will use their Journey chips to help Aptiv and their Wind River subsidiary, a provider of critical mission intelligent edge software, create fully integrated hardware and software solutions for automakers.

Aurora expects to complete a prototype of their lidar-on-chips by the end of the year. This chip is expected to be part of the company's self-driving systems from 2027, in **partnership with Continental**. This development should bring the cost per unit on par with competitors. Aurora sees their lidar sensors as a unique advantage: it can measure the speed using a FMCW technology and a continuous beam of light.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

New BMW 7 Series Will Self-Drive With Lidar

Certain 2024 BMW 7 Series cars will be able to drive themselves. The feature is set to launch in Germany this December; no U.S. release date has been announced. The system will automatically disable itself outside of specific geographic regions; currently, laws relating to self-driving cars differ massively from state to state.

BMW's system will be similar to the Mercedes-Benz setup within the scope of what is legally possible in Germany. The Traffic Jam Pilot can be activated only on the motorway in traffic jam situations up to a maximum of 60 km/h, and the car must detect it is in dense highway traffic and find a vehicle in front that marks the end of the traffic jam. The driver's eyes must be on the road, and their hands on the steering wheel. When the car decides these conditions have been met, the driver will be invited to tap a new button on the steering wheel. This activates L^3 self-driving.

However, while L^3 driving can only be activated during the day and in good weather with Mercedes-Benz Drive Pilot, BMW plans to use it in the dark, too. Like Mercedes-Benz, the feature will not work in construction sites, rain, or subfreezing temperatures. Automatic lane changes are also not yet possible.

The car is equipped with an Innoviz long-range solid-state lidar, said to cover 250 m and a field of view of 120 degrees horizontally and 15 degrees vertically at a resolution of 0.1 degrees.

DVN comment

BMW is the 4th car maker introducing L3 functionality after Honda, Mercedes-Benz, and Hyundai-Kia. HK allows a maximum speed of 80 km/h vs 60 for Mercedes-Benz and BMW.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Hesai-Led Group Makes Progress on Automotive Lidar ISO Standard

Hesai's tech experts joined the 2023 annual meeting of the ISO Electrical and Electronic Components and General System Aspects Subcommittee (ISO/TC22/SC32) under the Road Vehicles Committee (ISO/TC22) in London, England. They presented their pre-research work on the global ISO standardization of automotive lidar. In this meeting, the standard pre-research work for three preliminary work items, including ISO/PWI 13228 (Test Method for Automotive Lidar) was accepted by all committee participants for further voting.

The committee made the following resolutions on ISO/PWI 13228, ISO/PWI 13389, and ISO/PWI 13377:

- If the NP (new work item proposals) for IS 13228 and IS 13389, and the CIB (committee internal ballot) for TR 13377 are approved, SC32 will support further plans on the IS 13228, IS 13389, and TR 13377.
- If any of IS 13228, IS 13389, or TR 13377 is approved, SC32 agrees to combine the three AHGs and set up a new WG.

The focus of the ISO/PWI 13228, "Test Method for Automotive Lidar," is to provide global standards for (1) automotive lidar-related definitions and technical specifications, (2) performance specifications, (3) test methods to evaluate the performance of lidars, and (4) instructions for market regulation and management.

Early last year, the automotive lidar ISO International Standards Pre-research Group AHG12 was established. 41 experts from 8 countries participated in the pre-research work, with experts from Hesai serving as the project leader and Valeo serving as the co-leader. Over the next one and a half years, AHG1 held eight meetings to determine the scope, framework, and draft of the new ISO/PWI 13228 standard and requested to initiate the New Work Item Proposal (NP) ballot, successfully progressing to the next stage.

As lidar becomes increasingly integral and widespread in autonomous vehicles, standardized tests and quality regulations will be critical to support large-scale production and delivery. These norms will create an environment that fosters the virtuous development of the industry. Being at the forefront of autonomous driving lidar R&D, Hesai has taken up the responsibility to use their technical expertise—in laser, manufacturing machinery, electronics, software, and more—to lead the standardization process.

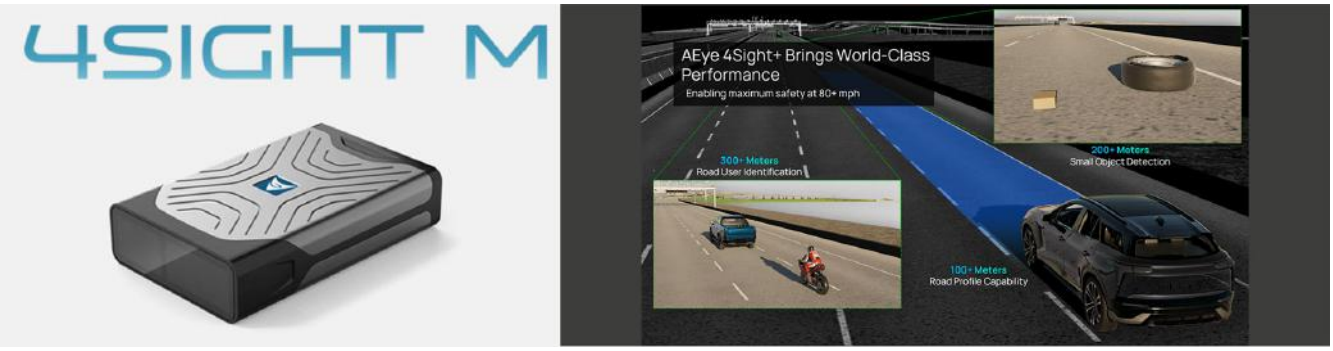
In addition to leading the development of lidar ISO standards, Hesai also put forward the UL Standards Lidar and Lidar Systems UL4700 proposal in February 2020. The UL standard covers lidar functional safety, network security, safety of the intended functionality (SOTIF), electrical machinery safety, and more. It has since been incorporated by the American National Standards Institute. In February 2022, Hesai also joined the International Electrotechnical Commission TC 76 Standardization Committee and contributed to the formulation of the IEC 60825 Optical Radiation Safety Series standards.

DVN comment

This milestone not only represents a step towards better standards for automotive lidar but also underscores Hesai's and Valeo’s leadership in global automotive component standardization.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

AEye's New 4Sight+ Boosts Spatial Resolution, Range



AEye has announced 4Sight+, the newest addition to their Intelligent Sensing product line, which delivers industry-leading path-planning, obstacle avoidance, and prediction capabilities. AEye applied their software-defined architecture to improve the sensor's range by 20 per cent and spatial resolution by 400 per cent, extending its high-speed small obstacle detection capabilities, while enabling the same hardware to address hazardous vehicle cut-ins—providing an all-in-one solution for automakers.

The data fidelity and range upgrades in 4Sight+ bring an increased level of dependability, performance, and adaptability from AEye to help OEMs eliminate phantom braking, improve existing ADAS features, and safely enable hands-free driving at highway speeds.

4Sight+ takes advantage of the platform's modular, bistatic system that can reconfigure lidar performance on-the-fly and add new capabilities over-the-air. Powered by a tiny MEMS device that allows for ultra-fast, yet robust movements, the 4Sight Intelligent Sensing Platform is inherently designed to be highly programmable to meet performance requirements for both urban and highway driving using a single platform.

4Sight+ improves prediction capabilities by tracking vulnerable road users, including pedestrians, cyclists, and other vehicles, at up to 300 meters. It improves vehicle ride quality and reaction time by detecting small objects, like bricks and tires, at up to 200 meters, and it helps with vehicle path planning by identifying road surfaces, such as cement and asphalt, at up to 100 meters, including in direct sunlight and low light environments. These advantages allow AEye to enable predictive safety systems for a smoother, more comfortable hands-free driving experience at 80+ mph, without requiring driver intervention.

The advantages of a software-defined sensor allow the same hardware to address close-up vehicle cut-ins, long-range views, and everything in between. Automakers can leverage AEye's scanning agility to completely reconfigure the lidar's performance instantaneously, using cues from other sensors in the vehicle, such as speed or GPS location to activate uniquely defined modes of operation for parking, urban, and highway environments.

By optimizing lidar performance based on driving conditions, the sensor continues to achieve high-performance, while operating at the lowest power required. This also allows for flexibility in form factors—an important consideration for seamless vehicle integration as automakers pursue electrification.

DVN comment

The 4Sight+ platform is highly programmable and can be reconfigured in real time to meet the demands of city and highway driving. The main evolution is the fact that it improves predictive capabilities by tracking vulnerable road users up to 300 meters away, and that it detects small objects up to 200 meters away and helps with vehicle path planning up to 100 meters away.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Imaging Radar News

Road scene video and corresponding Imaging Radar 3D point cloud

ZF's Imaging Radar was honoured at the prestigious Automotive Innovation Awards.

ZF's Imaging Radar received an award in the #AutomatedDriving and #ADAS category. The high-resolution radar perceives the vehicle's surroundings in four dimensions, including height. And thanks to detailed scene and object recognition with a range of up to 350 meters, it meets the high requirements of Level 3 and 4 automated driving.

The addition of the elevation angle helps generate an enhanced 3D image of the traffic situation, enriched with speed information, resulting in high-resolution environment sensing. This type of data helps a vehicle on a highway to detect the end of a traffic jam under a bridge at an early stage and brake accordingly. The Full-Range Radar also provides information that helps detect the edge of the road and whether there are free passing areas at the side of the road.

Full-Range Radar is an important addition to ZF's comprehensive sensor set for automated driving functions. With an aperture angle of ±60°, it is designed for a wide range of situations: from slow city traffic to driving on country roads and highways. At 350 meters, the range is quite outstanding. It uses the 77 gigahertz band and the Fast Ramp Frequency Modulated Continuous Wave (FMCW) modulation shared with other radar sensors from ZF.

The imaging radar has a much higher resolution than standard #radars, which typically operates with 12 channels. In ZF's imaging radar, several MMIC (Monolithic Microwave Integrated Circuit) chips are combined so a total of 192—16 times more—channels are available. This high information density ensures, among other things, very detailed object recognition. ZF's solution receives around ten data points from a pedestrian. In comparison, typical car radars manage a maximum of two. The Imaging Radar from ZF can thus even resolve the movement of individual limbs, and thus detect the direction of movement of a pedestrian.

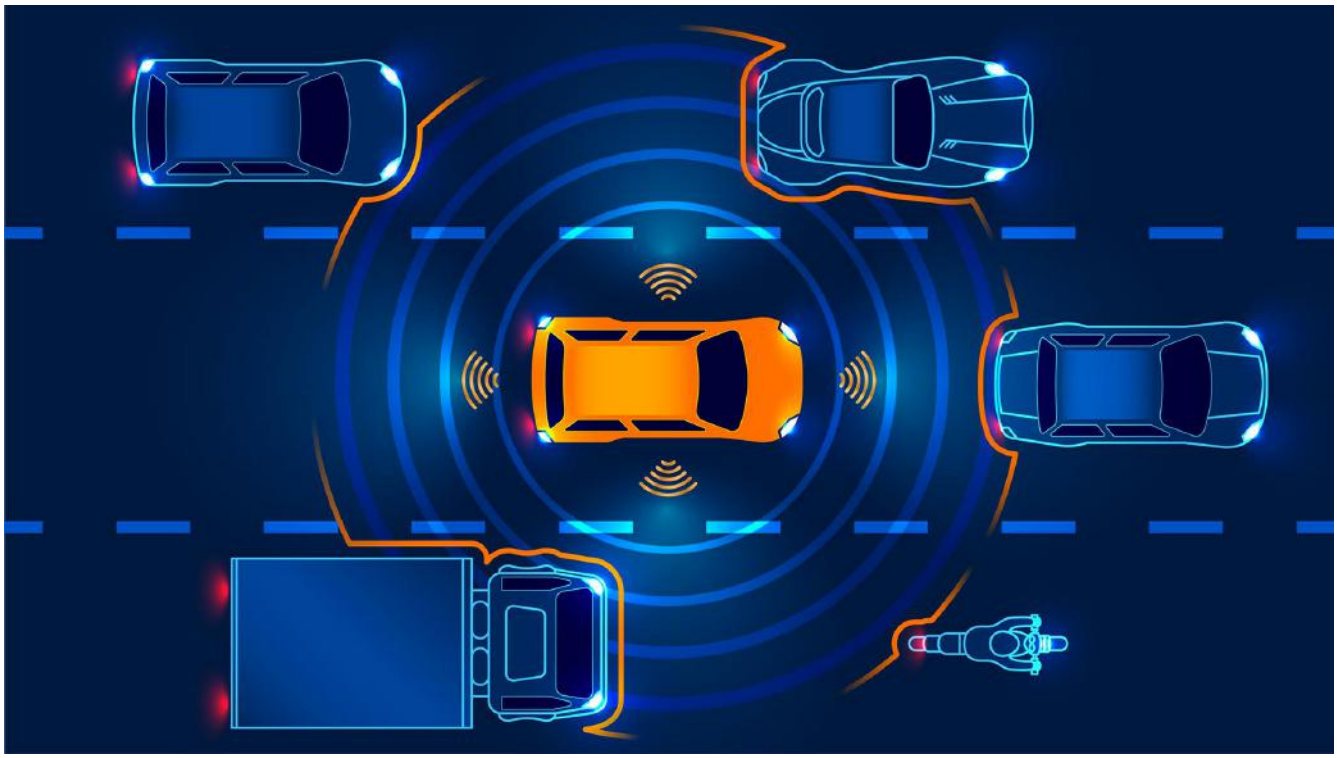
The Automotive Innovations Awards are presented by Centre of Automotive Management (CAM) and PwC Deutschland.

DVN comment

While retaining their clear advantages in bad weather conditions, imaging radars are getting closer to lidars for their better resolution. ZF has still received a production contract for this full-range radar technology from China’s SAIC Motor Corporation. ZF began supplying this full-range radar to SAIC in 2022.

AUTOMATED DRIVING

AD User Experience News



Cruise has begun initial testing and data collection in Miami. The news comes two months after they expanded to Houston and Dallas, where they've begun supervised testing (i.e., there's a human safety driver in the car) and are on track to begin driverless ride-hail service for members of the public soon, according to a Cruise representative. Cruise will switch to driverless testing before opening up the service for riders.

VW has initiated their AD tests, which involve the transport of passengers (four per car), including government representatives, public authority figures, business executives, and journalists in Munich. Additionally, Volkswagen is conducting identical tests using ID.Buzz prototypes in North America.

VW has announced the launch of their inaugural AV testing initiative in Austin, Texas. The initial phase will involve a fleet of 10 all-electric ID.Buzz vehicles, equipped with a AD technology platform created in partnership with Mobileye. This initiative is a significant stride forward for the Volkswagen Group's global autonomous vehicle research and development.

Zoox has unveiled their purpose-built robotaxi in Las Vegas, paving the way toward a commercial launch of autonomous transportation services. The initial route is a one-mile loop surrounding Zoox's Las Vegas headquarters, with plans to expand in the coming months. The vehicle, capable of transporting four passengers and operating at speeds up to 35 mph, undergoes real-world tests, navigating various road conditions, traffic situations, and obstacles.

Haomo, the autonomous driving technology arm of Great Wall Motor, announced that their **Xiaomotuo** unmanned terminal goods delivery vehicle has completed over 200,000 delivery orders. Since November 2020, the Xiaomotuo has been operating in Beijing's Shunyi District and other regions. Service has been expanded to upscale communities in Shanghai and the Yizhuang area of Beijing. This past March, Haomo obtained the vehicle coding for unmanned delivery testing in the Beijing ICV Policy Pilot Zone.

WeRide officially launched their autonomous driving demonstration project in Dalian, the coastal city of China's Liaoning Province, on July 7 after 180 days of testing. Operations were launched with the WeRide Robobus and Robosweeper—the first autonomous vehicle fleet deployed in Dalian. WeRide deployed six autonomous buses (Robobus) and two autonomous street sweepers (Robosweeper), which will gradually operate on four autonomous bus demonstration routes and one sweeping route.

The **UAE** has approved the country's first autonomous-driving license and awarded it to Chinese L^4 AD technology company, **WeRide.** This marks the first national-level AD license in the Middle East and even globally. With this license, WeRide will conduct various road testing and operations of autonomous vehicles in the UAE. Dubai aims to have 25 per cent of its transportation demands accomplished by autonomous vehicles by 2030.

WeRide inaugurated their autonomous driving demonstration bus route in the Hengqin Cooperation Zone of Zhuhai city, Guangdong Province, China. The bus route, operating between Hengqin Port and Chimelong, is another autonomous driving tourist route in Hengqin. The route covers multiple scenic spots and commercial areas, offering citizens and tourists a novel, intelligent, convenient, and efficient mobility solution. The new route spans 7.2 kilometers.

Dongfeng Sharing, the autonomous driving arm of Dongfeng Motor, was recently granted the first commercial pilot license for autonomous buses in the Wuhan region. The autonomous driving bus, Sharing-BUS, was officially deployed and has been in trial operation for over a year since the May Day holiday last year. The fares for the unmanned buses are the same as traditional buses. The suggested fare for the yet-to-open rapid bus routes within 6 kilometers will be C¥3, with fare increments based on the distance traveled.

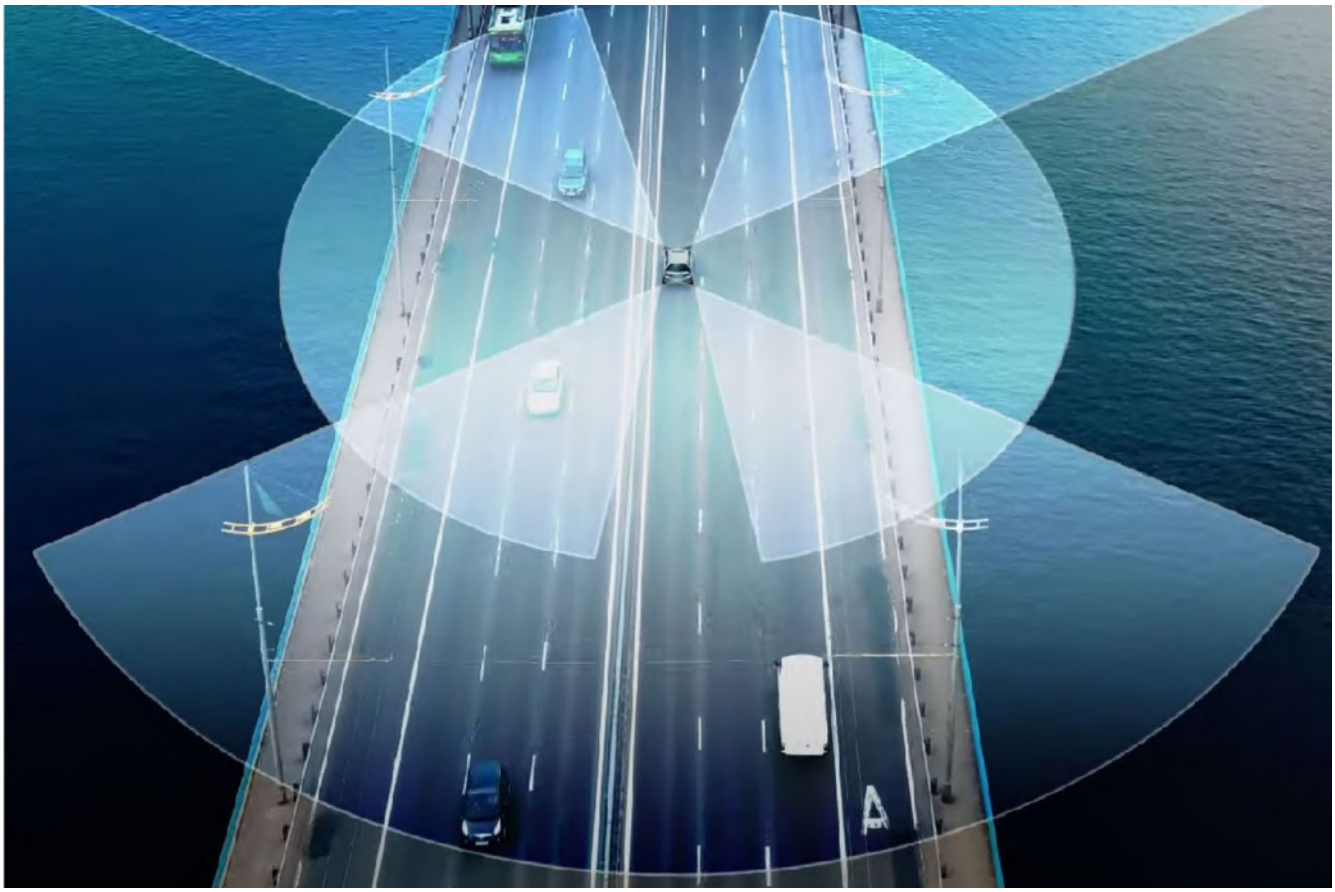
Loadsmith has teamed with **Kodiak Robotics** to pioneer the world's first freight transportation company specifically designed for autonomous trucks. Loadsmith has placed an unprecedented order of 800 self-driving trucks from Kodiak Robotics. This investment sets the groundwork for the Loadsmith Freight Network (LFN), the first-ever freight transportation operation wholly committed to using AVs. The transition to Kodiak-powered autonomous trucks is slated to commence in the latter half of 2025.

Iveco and **Plus** have announced that their jointly developed autonomous Iveco S-Way truck, integrated with the PlusDrive solution, is now operational on public roads in Germany. The data gathered during the public road testing phase will crucially set the stage for future industrialization.

Halo, a provider of on-demand electric vehicles, is launching remote-piloted EVs without a safety driver in Las Vegas. This launch succeeds four years of exhaustive testing with safety drivers. Users in Las Vegas can schedule a Halo car to be delivered to their location without a safety driver in. Trained 'remote pilots' at the operations center use video and sensor data for remotely driving the vehicle.

DVN-LIDAR DEEP DIVE

DVN-Lidar Deep Dive 3 Final Docket



The Lidar Deep Dive 3 is combined with the DVN Lighting Workshop. DVN Lidar participants can attend the first day of the DVN Lighting Workshop on 29 August, especially the lidar session just before the dinner.

29 August (combined with the Lighting Workshop)

Lidar Session - Lighting Workshop

18:15 **Cepton**: Optimizing Lidar Design for Seamless Vehicle Integration
18:30 **FKA**: An overview of Lidar Performance Testing Framework at FKA
18:45 **Covestro**: Enabling High Performance Lidar Through Polycarbonate
19:00 **Openlight**: High Performance Lidar Enabled by Heterogeneously Integrated Silicon Photonics

19:15 Q&A Session

19:20 Cocktail
20:15 Dinner

30 August (Lidar Deep Dive 3 event)

8:30 Opening and introduction of participants

Session 1: Lidar 360° Systems

9:00 [presenter tbc]: Lidar Applications lecture
9:20 **Hesai:** Lidar Applications for Robotaxis [title tbc]

Session 2: Lidar Perception Software and Simulations

9:40 **Valeo**: Valeo Lidar New Technologies, Complementarity with 4D Radars
10:00 **Siemens**: Simcenter Prescan Physics-Based Raw Signal Sensor Simulation
10:20 Conclusion: Four Questions to the Community

10:25 Coffee Break

10:50 Two breakout groups, each discussing two questions.
11:50 Breakout group reporting and discussion

12:35 Lunch Break

Session 3: Lidar FMCW Technology

13:50 **Hamamatsu**: FMCW Lidar: A Closer Look at the Principles of Operation and Technical Challenges
14:10 **SILC**: Enabling Mass Market Adoption of FMCW Lidar Through Chip Integration
14:30 Conclusion: Two Questions to the Community
14:35 Two breakout groups, each discussing two questions.

15:30 Coffee Break

16:00 Breakout group reporting and discussion
16:30 What did we learn together?
17:00 Closure