DVN
Lidar

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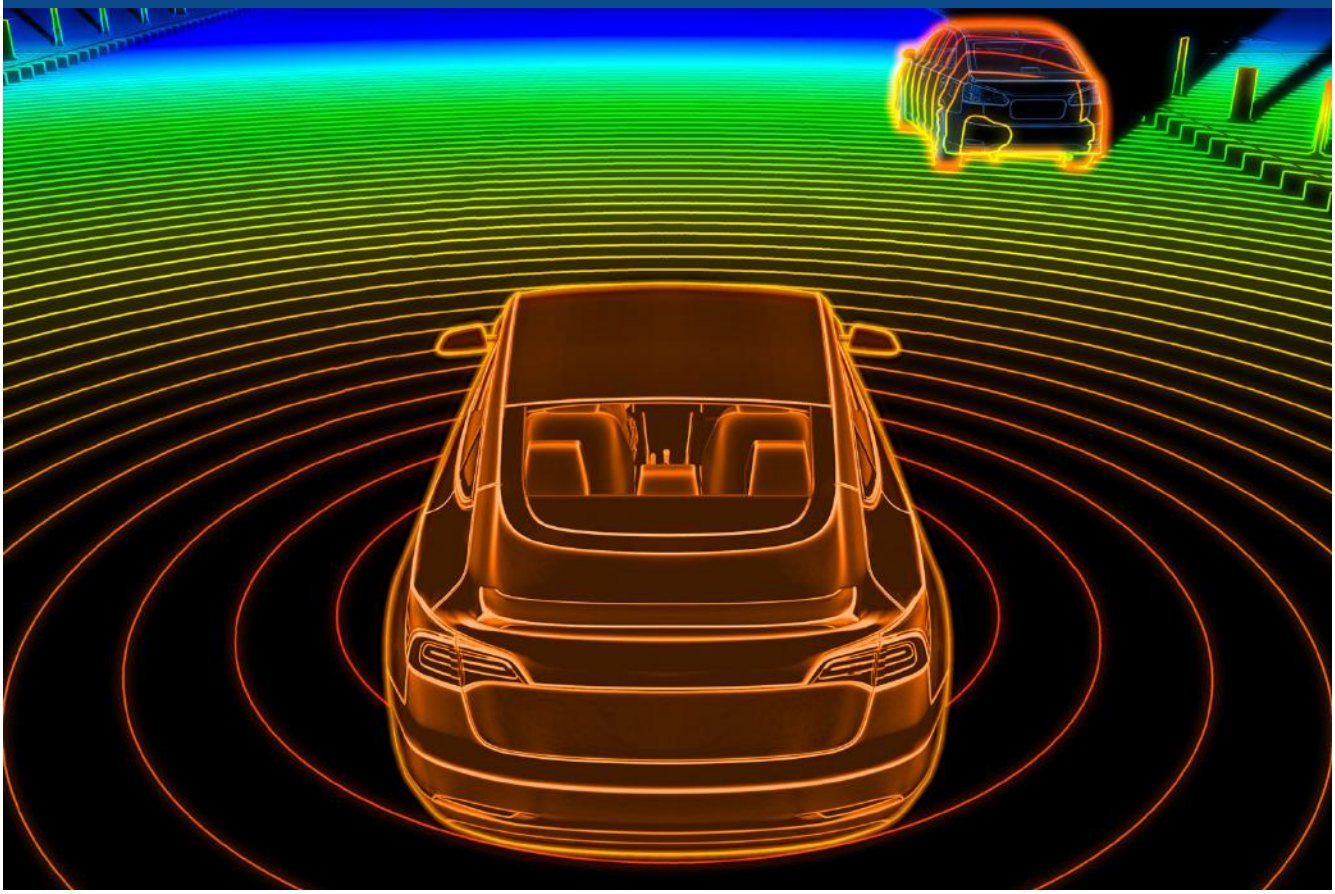


EDITORIAL

L2+ and L3 is Ramping Up Fast; Tectonic Shift in Lidar Industry

We saw at CES how the L^{2+} and L^{3} automated driving market is heating up fast. Mobileye, for example, announced cumulative orders for an expected lifetime volume of 3.65 million vehicles for their Supervision L^{2+} systems—up from 2 million last year—and 600,000 for their L^{3} Chauffeur system first ordered last year. Their main customers are Porsche, Geely, FAW, and a western maker not yet named.

Hesai and Robosense together delivered a record volume of 120,000 lidar sensors in December. At the same time, the German automotive industry is consolidating with bleak perspectives; Bosch, ZF, and Continental are phasing out from the lidar business to reduce costs—some real tectonic shifting in the lidar industry.
Chinese lidar suppliers are developing new products achieving L^{3} grade performance, improving the resolution from 1.2 megapoints per second (presently the Chinese state of things) toward 12 megapoints per second (Valeo Scala 3-level performance) to detect small objects 150 meters away.

All this being so, DVN-Lidar is global as of 2024, with a new presence in China through a partnership with Enmore to cohost the EAC event on 21-22 June in Suzhou. It is the biggest lidar expo in the world, with about 150 exhibitors and 1000 attendees. DVN-L Gold Members will get free tickets and will be able to register as an exhibitor on the DVN website. Speaking of which, here are the 2024 DVN-Lidar events around the globe; save these dates!

- Deep Dive 1 in Stuttgart, Germany: **9 April**
- EAC in Suzhou, China: **21-22 June**
- Deep Dive 2 in Detroit, USA: **12 September**
- Lidar Conference in Wiesbaden, Germany: **18-19 November**

We're ever so glad you're here with us in the DVN-Lidar community. Enjoy this 23d edition!
All best,

Alain Servel

DVN LIDAR ADVISOR

LIDAR BUSINESS

Lidar Business Newsbites

In December 2023, China's production volume of NEPVs reached 1.1 Mu (8.9 million over all of 2023, including 6.1 million BEVs and 2.7 million PHEVs),with an uptake rate of 41 per cent (35 per cent for whole-year 2023).

Key contributors in December are BYD (340k), SAIC-GM-Wuling (118k), Tesla (94k), Geely (60k), Li Auto (50k), Changan (47k), GAC AION (46k), Seres (36k), SAIC (35k), GWM (30k), Chery (21k), SAIC VW (21k), Xpeng (20k), SAIC-GM (19k), Leapmotor (19k), Nio (18k), BAIC (13k), BMW Brilliance (11k), and Voyah (10 k).

In December 2023, RoboSense delivered 72,200 lidar units, resulting in a volume of 151,000 units in the fourth quarter of the year—up 545.3 per cent compared to the same period in 2022. RoboSense's annual lidar delivery volume for 2023 reached 256,000 units.

Hesai announced a monthly lidar delivery volume exceeding 50,000 units in December 2023, a first in the automotive lidar industry. Customers include Li Auto, HiPhi, Lotus, Leapmotor, and Polestones, a Chinese SUV maker.

Daimler Truck and Torc will integrate Aeva's next-gen Atlas sensors on the 'autonomous-ready' Freightliner Cascadia platform. The collaboration begins in the first quarter of 2024, with Aeva's start of production by 2026. Daimler plans to put L^4 trucks on U.S. roads by 2027, with long- and ultralong-range lidar sensors installed during production, so trucks are built for autonomous driving with no need for sensors to be installed later. Torc will sell their Virtual Driver technology and supporting Mission Control services as a subscription.

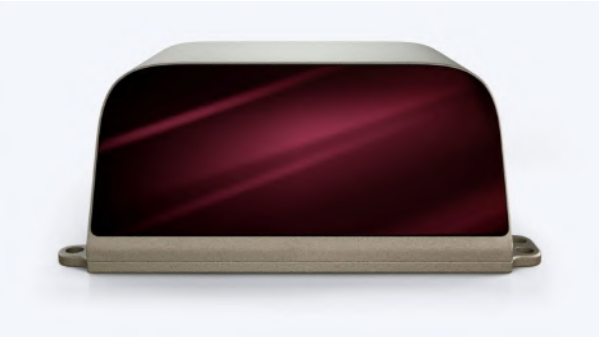
Hesai announced a collaboration upgrade with Neta, the new energy vehicle maker under Hozon Auto. The partnership aims to incorporate Hesai's 128-line ultrahigh-definition AT128 lidar into Neta's upcoming vehicle model, powering the Neta Pilot intelligent driving system designed to cover a wide range of travel scenarios. The new vehicle is set to debut this year.

Lotus' newly-released Emeya electric sedan has Hesai's AT128 lidar. The cutting-edge model features a comprehensive intelligent driving assistance system and is equipped with two Hesai AT128 long-range lidar units as the main sensor for front and rear perception. Lotus positions the AT128s on the roof and rear wing, introducing a unique hidden and foldable lidar design that blends elegance with reduced aerodynamic drag. The Emeya has a total of 34 intelligent driving sensors and dual Nvidia Drive Orin chips.

Speaking of the Lotus Emeya, it has two state-of-the-art RoboSense M Platform side lidar sensors. Lotus also put M Platform sensors on the Eletre, the company's first electric SUV, unveiled in March 2022. The sensor has a wide, 120° × 25° FoV, and can detect roadway objects at up to 200 m with 1.5 megapoints per second.

RoboSense revealed the new M3 at CES 2024, with a 300-meter detection range at 10-per-cent reflectivity. This, together with high 0.05° × 0.05° resolution, lets the M3 detect small distant obstacles—such as a traffic cone at 270 m with 6 points, a standing child at 200 m with 8 points, and a black tire at 130 m with 8 points.

LG and Magna have unveiled a revolutionary platform merging cutting-edge autonomous driving and immersive infotainment. The collaboration seamlessly integrates ADAS, AD, and in-vehicle infotainment into a single, powerful SoC. It is expected to debut in 2027 models.



Aeva secured a tier-1 supply contract for the series-production vehicle program of an as-yet-unnamed global automaker. The multiyear production program is expected to generate revenue as early as Q1 this year, with a significant ramp-up projected by mid-decade. Further details regarding the partnership are promised over the coming weeks.

Continental and Aurora Innovation are finalizing the design and architecture of the Aurora Driver's hardware and fallback system, which they say paves the way for mass production of reliable self-driving trucks starting in 2027.

Innoviz Technologies is laying off 13 per cent of their workforce, in an effort described as optimizing the company's cost structure, increasing their competitive positioning, and extending their cash runway through the expected remainder of the market capture window. Innoviz has supply contracts with at least two carmakers: VW Group and BMW Group, which has begun to install Innoviz sensors in production cars including the 7 Series.

Hesai Technology is among more than a dozen Chinese companies newly added to a U.S. Defense Department list of firms allegedly working with Beijing's military, as part of a broader effort to keep American technology from aiding China. New additions to the list, first reported by Reuters, also include memory chip maker YMTC, artificial intelligence company Megvii, and tech company NetPosa.

INTERVIEW

DVN-L Team Profile: Eric Amiot, Head of DVN-Lidar

Eric Amiot has an electronics engineering degree from the University of Supelec, Paris. He has long experience in the high-tech field and business development for ADAS products (radar, camera, and lidar). He started in a radar startup, and has been working for 25 years in the automotive industry at Valeo.

Amiot joined the DVN organization at the end of 2022 to support and accelerate lidar-related activities. Today we bring you this interview to get his feedback about 2023 activities and thoughts for 2024.

Q: How has been your experience so far with DVN-Lidar?

Eric Amiot: This was the second year of activity of DVN-Lidar, and my first year as manager. The Lidar Conference was for me the key event to get a deep understanding of the community and its expectations.

We have a strong community because we have a clear focus. With DVN-Lidar you get a clear understanding of the market, the technologies, the ecosystem. Our conference provides a unique occasion to gather all the experts and players on the same place, so you can get answers to your questions!

And we can see the impact of the consolidation of the Lidar industry. Some members left (startups closing or companies focusing on industrial applications), replaced by big players who will be part of the core business—like Mobileye, Sony, AGC Wideye, and more.

Q: What kind of feedback did you hear about the 2023 Lidar Conference?

E.A: I was pleased to get many positive comments at the conference; here are some examples:

“Well curated, well executed, of very high quality, and, most importantly, truly beneficial to all the participants. I liked the format” (Olga Raz, Optica—Director of Technology for Optics and Optical Systems)

“First time I attend. Best ADAS event I know. High Added Value, with a clear and strong focus (Lidar), which is almost never the case in other events. I will promote the event”. (Benazouz Bradai, Valeo—AD Innovation Director)

“It was a great conference and a good opportunity to connect with tier 1s and OEMs in the ADAS space” (Bob in den Bosch, Hesai—VP Global sales)

“Very good event, with the right size and people”. (Heiko Leipin, Continental—Lidar expert)

“Much better compared to other events like EAC in China which is more an exhibition” (Olaf Hug, Elmos Mechaless—Product Segment Manager)

Q: What were some of the big DVN-L achievements in 2023?

E.A.: The interactive working groups (Deep Dive Workshops) have been very usefull to bring clarity regarding the current lidar performance in bad weather conditions (Deep Dive1), the expected requirements for short-range lidars (Deep Dive 2), and the maturity of FMCW Lidar (Deep Dive 3).

At the Lidar Conference, we saw a clear breakthrough in vehicle integration and strong growth on the Chinese Market, based on L^{2+} ADAS applications, with a few suppliers reaching a volume of 50,000 sensors a month, which allows a full automation of the manufacturing process.

Q: How do you see the lidar market evolving?

E.A: The lidar market is clearly taking off with the Chinese OEMs and we should see Polestar and Daimler also start shipping in 2024. But there will be continued consolidation among the EU and US players—especially in Germany, with some of the big tier-1s scaling back activities for now (for example ZF terminated their autonomous shuttle project, and after Bosch, Continental will stop their partnership with Aeye.)

The shared mobility market is also slowing down in EU & USA. It was once a high priority for automakers, but not anymore. In 2022, VW’s WeShare sold to Miles. Renault Mobilize pulled the plug on their Paris car share operation, Zity by Mobilize, because of “factors external to the company such as significant damages repeatedly suffered by the fleet.” The last big car share player is Free2Move, owned by Stellantis, who recently bought Share Now (a merger between Mercedes’ Car2Go and BMW’s DriveNow). Share Now was losing the two German makers around €100m per year. And GM-Cruise recently lost their license in California and pulled their whole fleet off the road, and the regulators are adding more constraints to the deployment of robotaxis.

There are also possible impacts of the US restrictions applied to Chinese tech companies. The Pentagon has just added Hesai to the list. If so, it might get complicated to have global suppliers.

Q: What will change at DVN-Lidar in 2024?

E.A.: There will be 4 innovations in 2024:

- DVN-Lidar will start activities in China: it is important for us to be present in the biggest lidar market, so we signed a partnership with Enmore to co-host the EAC lidar event in Suzhou. EAC, with 150 exhibitors and 1000+ attendees, is the largest auto electronics exhibition in China, including a big hall dedicated to lidars. DVN-Lidar will bring our expertise to build the program of the conference. DVN-Lidar Gold Members get 2 free tickets. It will also be possible to book an expo booth for EAC on the DVN website.
- We will expand the scope of the Lidar Conference, with a session dedicated to IR cameras. We believe this technology, like lidar, will have a specific role to improve the ODD and safety of automotive detection systems for AVs. The two technologies will be complementary to achieve a reliability of 99.99999 per cent that pure vision systems and AI cannot guarantee.
- DVN-Lidar will be involved in the realization of standards and technical studies related to lidar performance; we have started a joint project with FKA regarding lidar performance in adverse conditions, to define standards and tests and assess the risk of interference between automotive lidars. The final review should happen on 18 November, before the opening the Lidar Conference 2024, and DVN-Lidar will publish a report regarding lidar interference risk management.
- The DVN-L Newsletter has been restricted to DVN-Lidar members, starting from January of this year. The DVN lighting community doesn't have access anymore by default; companies still interested must send us a specific request.

Q: What's on the docket for 2024 DVN-Lidar events?

E.A.: in 2024, the following events will be organized for the DVN-Lidar community:

- Deep Dive 1 in Stuttgart, Germany: **9 April**
- EAC in Suzhou, China: **21-22 June**
- Deep Dive 2 in Detroit, USA: **12 September**
- Lidar Conference in Wiesbaden, Germany: **18-19 November**

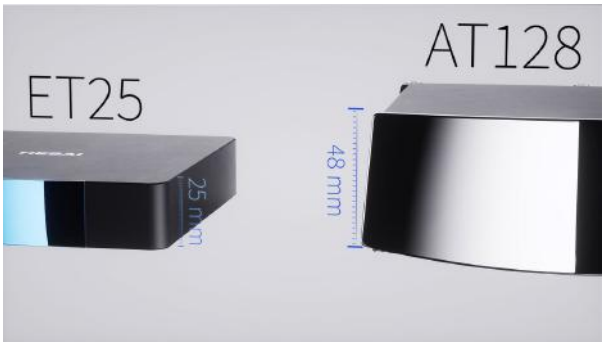
SPECIAL REPORT

CES 2024 - Special Report

Hesai

Hesai Technology won a CES Innovation Award this year for their ultra-thin, long-range ET25 lidar.

Designed specifically for placement inside the vehicle's cabin behind the windshield, the ET25's ultra-thin form, low noise levels, and high performance are said to be significant advancements.



The size difference from Hesai's popular AT128 is quite striking—its height has been nearly halved. And upgraded laser receivers increase the ET25's sensitivity over the previous unit; its range has been improved to 250 m (with no windshield in front of it; 225 m with), versus the AT128's 200 m.

The new lidar has a 120°H × 25°V view field, a point frequency over 3 megapoints per second, and resolution of 0.05° × 0.05°. It's only about 2.5 cm tall, and very quiet at 25 dBa—both figures suiting it well for in-cabin placement—and it uses just 12W. It's a 905-nm unit, and while its 3-megapoints-per-second performance might sound low, it's said to suffice for hands-free systems like GM's Super Cruise and for enhanced automatic emergency braking systems. LRather than a rotating mirror, it uses a proprietary beam steering system which Hesai are keeping quiet about.

And then there's the new AT512, a high-performance item for mounting above the windshield, like the Luminar units on Volvo, Polestar and SAIC vehicles. But unlike the 1,550-nm Luminar lidars, all Hesai sensors use 905-nm lasers; they cost less, but their power output has to be limited to avoid causing eye damage.

Despite the lower power, Hesai claim a detection range of 300 m for a 10%-reflective target, and resolution of 2,400 × 512 pixels over a 120°H view field-rate. The AT512 has 8 times the resolution of the existing AT128, and is slightly more compact. It can generate 12.3 million points per second at 10 fps.. The product's sleek physical design measures just 160x100x45mm

Lumotive

Lumotive won a CES Innovation Award for their LM10 LCM Module, which they call the world's first commercialised optical beam steering semiconductor. They say it offers true solid-state, zero-inertia beam steering, an ultrawide view field of up to 180° (with expansion optics), an 11 × 9 mm active aperture area to fit easily in a variety of system designs, and compatibility with all laser types, including VCSEL and EEL.

The LCM-enabled digital beam steering is said to deliver the performance of a scanning lidar sensor without the associated cost, bulk, and reliability questions of mechanical systems. Lumotive say this is the key to new kinds of lidar to make high-quality 3D sensing more readily accessible. To demonstrate the point, Lumotive presented their M30 Lidar Reference Design, built round the LM10 digital beam steering chip. The photo above, with a standard golf ball next to the M30, shows its remarkably small size.

Zvizion

Chinese lidar provider Zvizion showed off their latest SPAD lidar, the EZ6. It's targeted for long-range ADAS applications. The maker says its 'novel architectural design' (which seems a bit bulky compared to the Lumotive M30 we just finished talking about...!) attains high chip-level integration for lower cost, (about USD $280). With 192 channels, the EZ6 achieves point cloud characteristics with imagelike quality and improves the identification of low-lying obstacles.

It is said to be resistant to dirt accumulation and, in the event dirt does build up, it has advanced dirt-detection algorithms.

SOSLAB

SOSLAB's seventh (and largest-ever) CES booth had a section devoted to autonomous driving, where they showed off their 3D solid-state lidar technology, seamlessly integrated into the front and rear lamps of premium sedans. Commercialisation is planned in coöperation with an established vehicle lighting supplier. They also showcased their ML-A (for "Mobility Lidar"), a complete 3D solid-state lidar solution which takes modular optics to adapt the view field to the needs of the application.

The company are preparing for an initial public offering on the Korean KOSDAQ market in the first half of this year.

Robosense

The Robosense booth bristled with automotive technology, including the M Platform second-generation smart MEMS lidar; the E1 solid-state lidar with Robosense-developed chips; the Helios customised lidar platform including 16- and 32-beam lidars; the Ruby Plus upgraded 128-beam lidar customized for commercial L4 AVs, and the Bpearl 360° × 90° short-range blind spot lidar.

The Helios series is Robosense's new generation of customized multi-beam lidars. They're built with a new modular architecture. Compared to the RS-Lidar-32, a Helios lidar 29 per cent smaller and 60 per cent lower in cost. It supports customisation of beam number

distribution; the 32-beam Helios 32 is available in three subtypes to meet the needs of different applications: one with a 26°V FoV, with vertical angular resolution up to 0.5° and long perception distance...one with 31°V FoV offering uniform 1° vertical resolution...and one with 70°V ultra-wide FoV meeting perception and blind spot detection needs, thus simplifying on-board sensor placement. The 16-beam Helios 16 offers 30°V FoV, and has been extensively upgraded in performance and functions versus the previous RS-Lidar-16.

The E1 is billed as a solid-state blind spot lidar with Robosense-developed chips. It boasts a 120°H × 90°V FoV, and is meant for use in forward-looking M-series products to achieve panoramic perception and eliminate blind areas. It's got an ultra-fast frame rate of 10 to 30 Hz, and stronger range detection capability: 30m @ 10%.

The M3 is designed to be used in L^3 vehicles. It uses the 940-nm wavelength, rather than more costly 1,550-nm technology. It is said to be able to detect a 10-per-cent-reflective target at 300 m and work at up to 120 km/h, and Robosense claim it achieves better performance than 1,550-nm lidar despite being as much as 70 per cent less expensive, half the size, and consuming 30 per cent less power. Its modular design will allow will allow customers to upgrade seamlessly to future iterations without vehicle design changes

The M2, for its part, is more or less a lower-cost version of the existing M1 and M1 Plus. Robosense say it can detect a 10-per-cent-reflective target at 200 m.

Asensing

Ten-year-old Chinese supplier Asensing debuted their A2 lidar sensor. It is compact, with customizable features. It's designed specifically for ADAS and AD and is slated for scalable production and shipment this year.

The A2 was showed alongside positioning products and solutions including their "P-Box" integrated navigation system, their IMU inertial measurement unit, and their High-Precision GNSS Positioning Module.

Mobileye

Mobileye announced cumulated orders for an expected lifetime volume of 3,65 Mveh for Supervision systems (vs 2 Mveh last year) and 600 kveh for Chauffeur Systems (first orders in 2023). Main customers are Porsche, Geely, FAW and a western OEM not yet public.

Mobileye's main product launch this year was their DXP (for Driving Experience Platform), designed to allow automakers to provide a customised, brand-specific driving experience without costly, resources-intensive in-house program development. Mobileye say the platform, along with universal general-needs components, provides automakers with "AI tools" to program the vehicle's functionality. This facilitates software-sharing across multiple models, cutting down on the need to develop software for each and every vehicle.

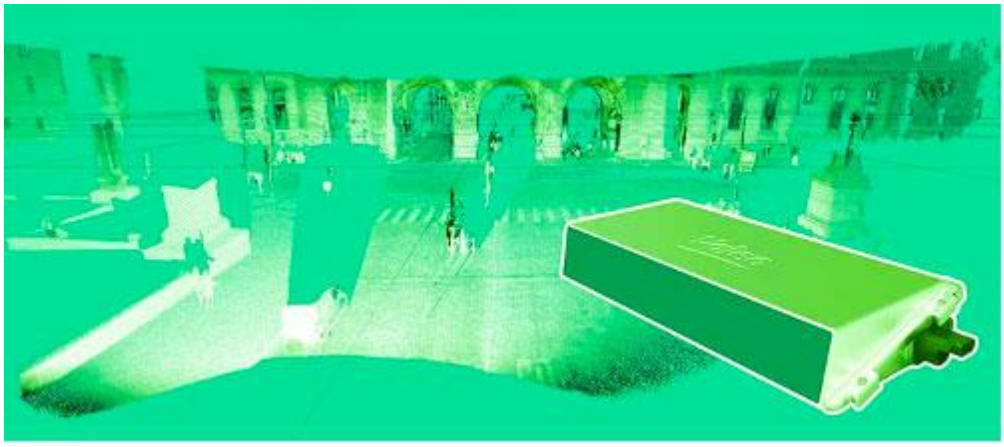
The platform comes preloaded with thousands of adjustable parameters, providing a wide range of options to tailor the self-driving system to their specific requirements and preferences.

Mobileye also proudly announced new supply agreements, including with 'a major Western automaker', particularly for Mobileye's SuperVision, Chauffeur, and Drive products, to be applied in 17 combustion and EV models starting production in 2026. Chauffeur offers hands-off/eyes-off autonomous driving in defined ODDs; it works with input from radar and lidar sensors. Mobileye and the unnamed automaker also will work toward commercialising fully autonomous vehicles incorporating the Mobileye Drive platform, designed to produce purpose-built vehicles for use as robotaxis and mobility-as-a-service operations. Drive integrates computer vision, lidar and Mobileye imaging radar, with initial driverless deployments targeted for 2026.

All systems will use the Mobileye EyeQ6H systems-on-chip designed for powerful but efficient computing to integrate all sensing and REM crowdsourced mapping with safe driving policy. Mobileye also announced an expansion of their existing relationship with India's Mahindra & Mahindra. There, too, it's all about cooperative development of solutions based on Mobileye's EyeQ6 SoC and sensing and mapping software, including an intent to build a full-stack autonomous driving system.

The strategy of Mobileye is to develop systems “on the shelf” including standard sensors, to reduce development costs and speed-up reliability and performance improvements over a complete fleet of vehicles. Following this strategy, Mobile announced its high-resolution radars (corner radar and long range radar) will hit the market by end 2025 and plans the launch of its high resolution Lidar in 2028.

Valeo



Valeo picked up yet another CES Innovation Award for their seemingly unstoppably-popular Scala-3 lidar, the high-density point cloud and perception software of which enables high-speed autonomous driving—including in the only L^3 passenger cars authorised in Europe.

Valeo also showed their tele-operation solution in a BMW iX; the car, way over yonder at the BMW booth, could be driven by visitors at the Valeo booth. And there was an Audi Avant with Valeo's creative multimedia interior concepts.

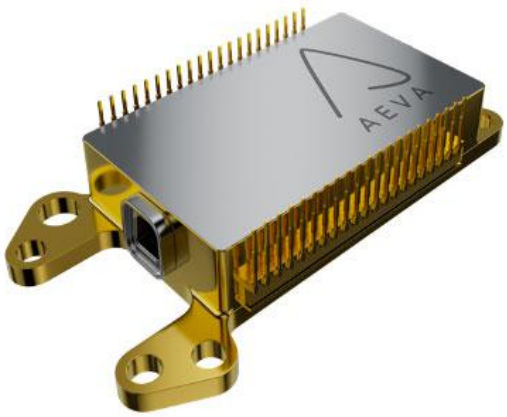
Luminar (+ Webasto)

Luminar put on a slick demonstration in the Convention Center parking lots, where their Iris+ lidar-centred Proactive Safety system, in Luminar's words, provided "higher-confidence detection, faster and farther than today's most advanced camera and radar powered ADAS (and shows) how new automatic emergency steering capabilities can help avoid collisions at high speeds without driver intervention".

It has a single eye-safe 1,550-nm fibre laser and what Luminar call "the most sensitive, highest dynamic range InGaAs detector in the world". It uses 2-axis scanning mirrors with 120° × 28° FoV, and scans only the laser rather than spinning the whole lidar device. Two vehicles lined up side-by-each, one with and one without Luminar's lidar tech. Once they were up to speed, a rigged dummy pedestrian darted out from behind a parked car. The Luminar SUV swerved to avoid the dummy. Then the other vehicle, went. Without inbuilt Luminar tech, it hit and ran over the dummy in its lane.

Luminar's outdoor exhibit also featured Kodiak Robotics and Plus autonomous trucks with Luminar lidar. And another exhibitor, Webasto, tidily integrated a Luminar long-range lidar into their Roof Sensor Module (RSM), where the elevated position is best for ensuring reliable monitoring of the vehicle's surroundings.

Aeva



Aeva gave ride-along demo drives through the trafficky streets of Las Vegas with real-time visualizations from the supplier's Aeries II 4D lidar—including instant velocity measurement, 'Ultra Resolution', long-range object detection, simultaneous velocity and 3D position detection, and immunity to interference.

They also unveiled their new Atlas, which they call the first 4D lidar sensor designed for automotive mass production. It leverages Aeva's innovations in custom silicon technology including their newest CoreVision lidar-on-chip module, and their new X1 SoC lidar processor.

Aeva expects to release Atlas products for production consumer and commercial vehicles starting next year, in 2025.

Opsys

Opsys' SP3.0 lidar, a windshield-integrated design developed in collaboration with Wideye by AGC, will be available for the market this year.

The setup integrates high- and low-resolution sensors to support long and short-range detection for Highway Pilot and high levels of autonomous driving (AD). The capability to integrate a lidar behind a windshield addresses three key long-standing challenges: the lidar is not on the roof; it works behind glass, and it produces little heat.

Opsys' true solid-state scanning lidar, with a precise beam pattern, can compensate for potential distortions introduced by a windshield. The lack of any moving parts in the Opsys sensor keeps things cool and silent during operation and makes the technology more reliable and easier to mass produce as it keeps costs down. It delivers all specs across the full field of vision with no installation limitations.

Even for challenging cases, such as a 70° windshield angle, the lidar still delivers sufficient performance to detect small highway debris according to Highway Pilot specifications. Opsys' SP3.0 lidar for windshield provides a B-sample level of maturity, ready to support any customer project.

Two independent lidar modules are embedded into a common structure with multiple cameras, rain/light sensor, and RFID antenna, to create a low-volume package behind the rearview mirror. Great attention was taken to ensure the driver's view remained unimpaired, so that the overall width of integration is within the legal limit.

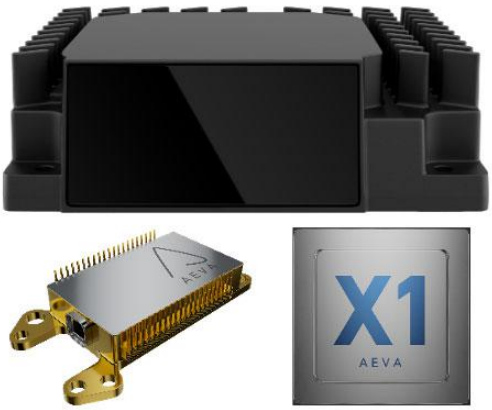
Seyond (Innovusion)

Seyond (formerly Innovusion), showed a Nio ET7 EV equipped with Seyond's Falcon sensor, as well as a new, fully functional prototype of Wideye's practical and visually seamless integration of lidar systems behind vehicle windshields, developed with Seyond.

Seyond recently passed a significant production milestone, becoming the first lidar provider to deliver 200,000 total units for vehicles. The company is one of the leaders in the lidar industry through key collaborations with companies including Nio and Wideye among others. Seyond's automotive-grade product Falcon, is currently being used in eight Nio models. Seyond's medium-range, wide-angle Robin-W sensor is also being used in the Nio ET9 model in tandem with the Falcon.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Aeva Atlas is First 4D Lidar Sensor for Automotive Mass Production



Aeva says their new Atlas is the first 4D lidar sensor designed for mass production automotive applications.

It is powered by Aeva's innovations in custom silicon technology including the CoreVision lidar-on-chip module and X1, a powerful new SoC lidar processor.

Aeva cofounder and CTO Mina Rezk calls the Atlas "the key development that will enable OEMs to equip their vehicles with advanced safety and automated driving features at highway speeds by addressing challenging use cases that could not be solved before. Importantly, we believe it will accelerate the industry's transition to FMCW lidar technology, which we believe is increasingly considered to be the end state for lidar, offering greatly enhanced perception solutions that leverage its unique instant velocity data".

The CoreVision is Aeva's fourth-generation lidar-on-chip module, incorporating all key lidar elements including transmitter, detector, and a new optical processing interface chip in an even smaller module. Built on Aeva's proprietary silicon photonics technology, it replaces complex optical-fiber systems found in conventional ToF lidar sensors to ensure quality and enable mass production at affordable costs.

The X1, Aeva's powerful new FMCW lidar SoC, seamlessly integrates data acquisition, point cloud processing, scanning system and application software into a single mixed-signal processing chip. It is designed for dependability with automotive-grade functional safety and cybersecurity.

These innovations allow the Atlas to be over 70 per cent smaller and consume one-fourth the power of Aeva's previous lidar sensor, enabling operation without active cooling and allowing for seamless integrations behind the windshield, on the vehicle's roofline, or in the grille.

Using Aeva's FMCW 4D lidar technology, AVs can detect objects faster, farther away, and with higher confidence – instantaneously discriminating between static and dynamic points, and finding the precise velocity of dynamic objects. The Atlas delivers critical requirements for highway-speed driving with a 25-per-cent greater detection range for low-reflectivity targets and a maximum detection range of up to 500 meters. Atlas sensors are immune to interference from direct sunlight, signals from other lidar sensors, and from retroreflective objects like street signs.

Atlas sensors work with Aeva's perception software, which uses advanced machine learning-based classification, detection and tracking algorithms. Incorporating the additional dimension of velocity data, Aeva's perception software provides unique advantages over conventional ToF 3D lidar sensors including:

- Aeva Ultra Resolution: a real-time, cameralike image that provides up to 20 times the resolution of conventional 3D lidar sensors;
- Road hazard detection: small objects on the roadway are detected with greater confidence at up to twice the distance of conventional 3D lidar sensors;
- Dynamic object detection discriminates, determines the velocity of, and tracks all dynamic objects with high confidence at up to twice the distance of high-performance 3D lidar sensors;
- Vehicle localization estimates vehicle motion in real time with six degrees of freedom, for accurate positioning and navigation without the need for additional sensors like IMU or GPS
- Semantic segmentation divides the scene into drivable lanes and non-drivable regions, pedestrians, vehicles and other elements such as traffic signs, vegetation, road barriers and infrastructure;
- Pedestrian detection detects, classifies, and tracks pedestrians to improve safety where pedestrians are on the roadway or close to curbs.

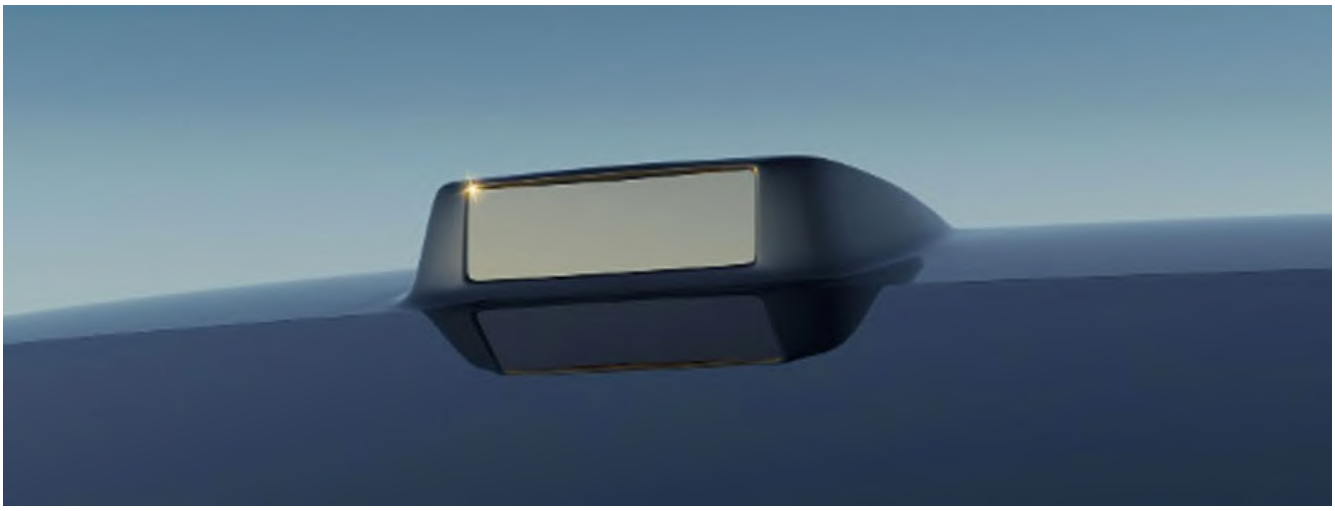
Aeva expects to release the Atlas range for production consumer and commercial vehicles starting in 2025, with samples available to some automakers and mobility customers earlier.

DVN comment

Doppler point cloud clustering is a good way to accelerate the segmentation of road scenes and objects. With their CoreVision lidar-on-chip module, Aeva could be, the first lidar supplier to offer a compact LoC architecture in large volumes.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Robosense M3 Long-Range 940-nm Lidar



RoboSense unveiled their latest M Platform line of sensors at CES 2024, including the M2 "ultimate midrange lidar" and the M3, the M Platform's first long-range lidar.

The M3 uses the 940-nm wavelength to achieve better performance, Robosense says, than a 1,550-nm lidar. It delivers a range of 300 m at 10-per-cent reflectivity, and 0.05° × 0.05° angular resolution within the region of interest to detect smaller objects at longer distances.

It has a modular design to enable performance improvement and cost reduction of next-generation models while maintaining form factor, interface, and scanning technology. This way, customers can upgrade their lidar sensors seamlessly without any design.

It's built around mature and highly reliable technology developed in house. The M3 is primarily designed to for L^3 or higher systems. The M3's ability to detect long-distance objects can meet L^3 functionality needs at up to 120km/h.

Robosense is the first lidar company to build their own chip technology, including MEMS, and the earliest to achieve mass production of automotive-grade solid-state lidar. As of December 2023, RoboSense has obtained 62 vehicle model design wins and successfully assisted 12 automakers and tier-1s in starting the mass production delivery of 24 models. In Q4 2023, the company's sales volume of lidar products reached approximately 147,500 sensors for ADAS (240,000 sensors over the whole year 2023).

DVN comment

Robosense enhances the performance of their M lidar family. The increased angular resolution is a good way to allow detections of small objects on roads, one of the main advantages the lidar can have in comparison with other kinds of sensors.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Phlux APD Sensors Give Lidar Sensitivity a Big Boost

UK startup Phlux Technology has launched their first family of avalanche photodiode (APD) infrared sensors using a high sensitivity technology.

The Aura family of 1,550-nm devices use the noiseless InGaAs APD technology developed by Phlux, with 12 times the sensitivity of other sensors, while being a drop-in replacement. The increased sensitivity of the drop-in sensors improves the operating range of lidar, laser rangefinders, and optical-fiber test equipment up to 50 per cent with existing surface mount or TO-packaged footprints.

Phlux created their noiseless InGaAs APD technology by adding an antimony alloy to the compound semiconductor manufacturing process. The resulting sensors can be operated with APD gains up to 120, enabling even the smallest signals above the noise floor of a connected trans-impedance amplifier (TIA) to be amplified. A further benefit of Aura APDs is their rapid overload recovery, which means that weaker secondary pulses that closely follow a large pulse can be detected.

The Aura sensors enable 12× greater lidar image resolution for a given laser power, up to 30 per cent reduction in system size and weight, and up to 40 per cent lower system costs. The size and cost reductions come from using lower-power lasers and smaller optical apertures without degrading system performance. Thermal management is simplified because Aura APDs operate at up to +85 °C without performance degradation, which is a significantly higher temperature than traditional parts.

Phlux CEO Ben White says, "Our Noiseless APD technology is a step-function leap in performance and provides tangible benefits for any company involved with 1,550-nm lasers. Automotive lidar is an exciting application where the move from 905-nm to 1,550-nm lasers is accelerating, not least because the latter is 'eye-safe'. But there are also huge opportunities for our products in telecommunications, laser rangefinders, imaging, spectroscopy, gas sensing and optical fiber test equipment, particularly optical time domain reflectometers".

The Aura APD 200 (200-µm optical aperture) and Aura APD 80 (80-µm optical aperture) sensors are available as bare die or in industry-standard SMD, chip on sub-mount, and TO-46 packages designed to meet MIL-STD 883.

Typical parameters for both devices are responsivity of 0.98 A/W at 1550 nm, spectral range of 950 to 1,700 nm, and excess noise factor of 1.86 at an avalanche gain of 40, or 1.08 at an avalanche gain of 10. At a gain of 10, the noise equivalent power for the Aura APD 200 diode is 17 fW/Hz0.5, its capacitance 2.4 pF, and its cutoff frequency 0.7 GHz. The equivalent figures for the Aura APD 80 are 11.1 fW/Hz0.5, 0.6 pF, and 1.8 GHz. Both devices have an operating temperature range of -40 to +85 °C.

DVN comment

This company is developing new infrared sensor technology that could transform the performance of laser range finders, lidar systems, and fiberoptic telecommunications test equipment. They're based in Sheffield, England, and they have large experience in InGaAs photodetectors. Their adaptation of APD sensors to a large light spectrum (950 to 1,700nm) with high sensitivity suggest that they can apply their technology to a wide range of lidars.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Valeo, Teledyne FLIR Agree Automotive Thermal Imaging Pact

Valeo and Teledyne FLIR have started a strategic collaboration to bring thermal imaging technology to the automotive industry to enhance safety. The two companies already secured a major contract, in late 2023, from a global automaker for their new thermal imaging cameras as part of a new generation of ADAS technology to improve vehicle and road safety.

Valeo and Teledyne FLIR will deliver the first ASIL-B thermal imaging technology for night vision ADAS. This system rely on Valeo's ADAS software stack to support functions such as automatic emergency braking at night as well as for autonomous cars.

Valeo will leverage their extensive expertise in automotive vision systems to integrate Teledyne FLIR thermal vision technology and supply the automaker with a complete solution for night vision, including perception software based on Valeo's AI and Graphical Visualization stack.

Teledyne FLIR VP and General Manager Paul Clayton says his company "continues to make tremendous strides in developing and incorporating thermal imaging into automotive safety systems, from aftermarket driver-aid technologies to autonomous robotaxis. Our work with Valeo enables us to make thermal imaging technology ubiquitous within transportation, from passenger cars to semi-trucks, allowing more drivers and automated vehicle safety systems to see in complete darkness, in cluttered environments, and in adverse weather where other incumbent sensors struggle".

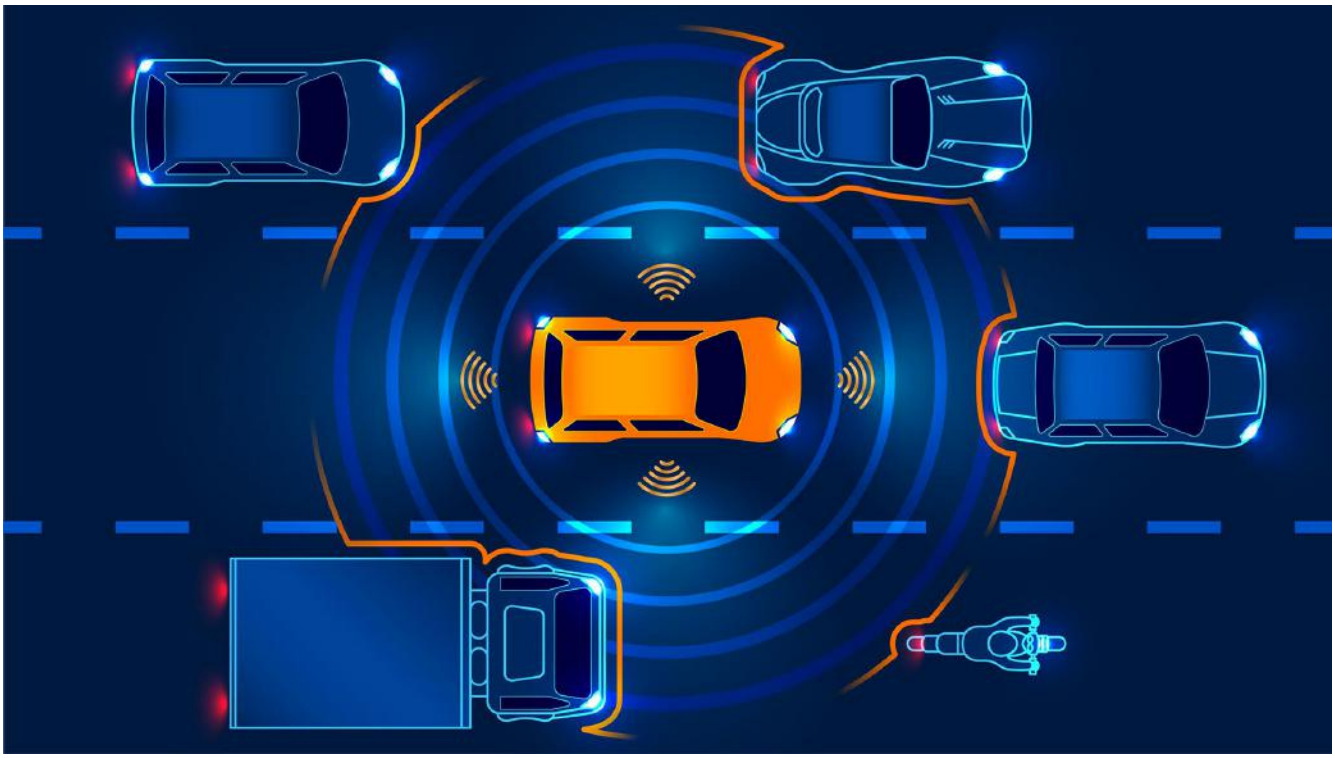
In the United States, preliminary data from the Governor Highway Safety Association found that 2022 marked the deadliest year on record for pedestrians since the organization began tracking such data in 1981. The record number of pedestrian deaths, with three-quarters occurring at night, highlights the need to do more to protect vulnerable road users, which also includes bicyclists and large mammals. In response, U.S. regulators are introducing proposed rulemaking for stricter testing standards for automatic emergency braking systems, including requiring testing at night.

DVN comment

Automatic emergency braking systems based on visible spectrum cameras can falter in night conditions. Teledyne FLIR has long experience on thermal cameras, and the increasing resolution of their recent products like FLIR ADK mean such sensors can be profitably integrated in existing ADAS sensing systems, so this partnership looks to have great promise.

AUTOMATED DRIVING

AD-News



OnTime, the ride-hailing platform under GAC Group, has obtained regulatory approval for passenger-carrying autonomous vehicle demonstrations in Shenzhen, adding that city to the first one (Guangzhou). The OnTime Robotaxi aims to provide safe, comfortable, and convenient autonomous driving services. In June 2023 OnTime, Pony.ai, and the authorities of Shenzhen's Qianhai Cooperation Zone signed a cooperation framework agreement, to establish a globally significant autonomous driving commercial pilot project.

IM Motors, the premium EV brand cofounded by SAIC Motor, Zhangjiang Hi-Tech, and Alibaba, announced that, starting January 23, their urban NOA (navigation on autopilot) will officially go live, with the primary urban area in Shanghai being the first to adopt this advanced intelligent driving feature. Activating urban NOA in designated city main roads allows for automated following of navigation paths, intelligent lane changes, turning at unprotected intersections, and obstacle avoidance. This year, IM Motors aims to expand the urban commute mode smart driving system to hundreds of cities, introducing advanced features like One-Key AI Valet 2.0, Memory Parking, and Automated Multilevel Parking.

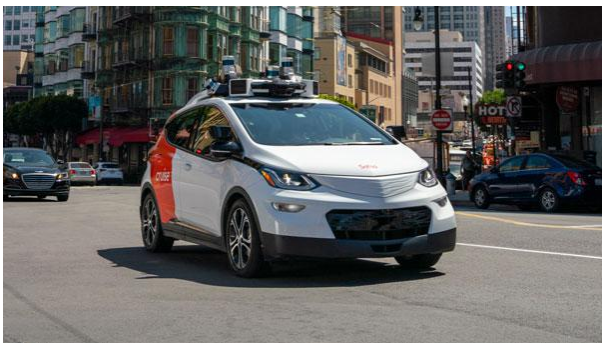
AC's Toyota Sienna Robotaxi, equipped with Pony.ai's sixth-generation AD system, secured commercial demonstration operation approval in Guangzhou's Nansha district. The operational range covers the entire 803 square kilometers of Nansha district. 15 of the robotaxis are included in the OnTime ride-share platform. It marks the second vehicle in Pony.ai's collaboration with OnTime, following the successful operation of the Lexus RX Robotaxi.

GAC Group secured an L^3 autonomous vehicle test license in Guangzhou at the end of 2023, which allows the company to conduct trials on designated highway and expressways in the city. GAC Group's TJP system facilitates lane centering and speed and distance maintenance, applicable at speeds up to 80 km/h, enabling drivers to divert attention from the steering wheel to other tasks while the system operates autonomously.

Avatr, the vehicle brand jointly developed by Changan, Huawei, and CATL, officially put the Avatr 11 ("one one") Harmony Upgraded Edition onto the market, with a price range of C¥ 300,000 to 390,000 (USD $42,00 to $55,000), including support for NCA (Navigation Cruise Assist) that operates independent of high-precision maps. In daily commuting scenarios, the map-free NCA autonomously plans routes for traffic-controlled areas, construction zones, and tidal lanes. The Avatr 11 has three lidar units as standard and advanced features like valet parking assistance.

Xpeng announced the extended reach of their XNGP (Xpeng Navigation Guided Pilot) intelligent assisted driving system, with the urban intelligent driving capabilities now encompassing 191 more cities, expanding the total coverage to 243 cities nationwide. Xpeng's official statement highlights the immediate integration of this enhanced functionality into the Xmart OS 4.5.0 system for existing users of the G9, G6, and P7i models. As long as users drive within the supported areas, they can seamlessly experience this cutting-edge driving assistance technology.

WeRide, in partnership with Guangzhou Bus Group, launched China's inaugural paid commercial shuttle service in Guangzhou, the provincial capital of Guangdong Province. WeRide and Guangzhou Bus Group initiated a fleet of 50 Robobuses for commercial operations, serving the central areas of Guangzhou. WeRide's successful Robobus implementation in Guangzhou has been replicated in 19 cities globally, including Beijing, Wuxi, Nanjing, Abu Dhabi, and Singapore.



Cruise has publicly released the Quinn Emanuel Urquhart & Sullivan report detailing findings about the incident in San Francisco last October, when a Cruise AV hit and dragged a pedestrian, which prompted regulators to suspend Cruise's driverless permits in California. Key findings from the review include Cruise's initial unawareness of the AV's action of dragging the pedestrian post-collision, and a later failure to update the press and regulators with complete information. It found that the technical cause was the AV's misclassification of the collision, leading to an inappropriate response. Cruise has since updated their software.

Huawei's automaking partner Seres has secured L^3 autonomous vehicle test licenses in both Chongqing and Shenzhen cities. This adds them to the list of automakers with such licenses in China, including BMW, Mercedes-Benz, IM Motors, Arcfox, Changan Deepal, and BYD. The Aito M9 uses the Huawei ADS 2.0 advanced intelligent driving system, and the Huawei 192-line lidar, along with radars, cameras, ultrasonic radar, and other sensors. Huawei's novel 192-line lidar offers a 250-meter range, 1.84 million points per second imaging capability, and a vertical resolution of 0.1°.

Ji Yue, the automotive robot brand jointly developed by Baidu and Geely, announced expanded coverage of their advanced urban intelligent driving capabilities to Beijing, Shenzhen, and Hangzhou. The Point-to-Point Autopilot (PPA) function is currently available in Shanghai, covering major roads in the city and extending to 90 per cent of the national highways across China. Ji Yue's advanced urban intelligent driving functions will progressively extend its coverage to over 200 cities nationwide.

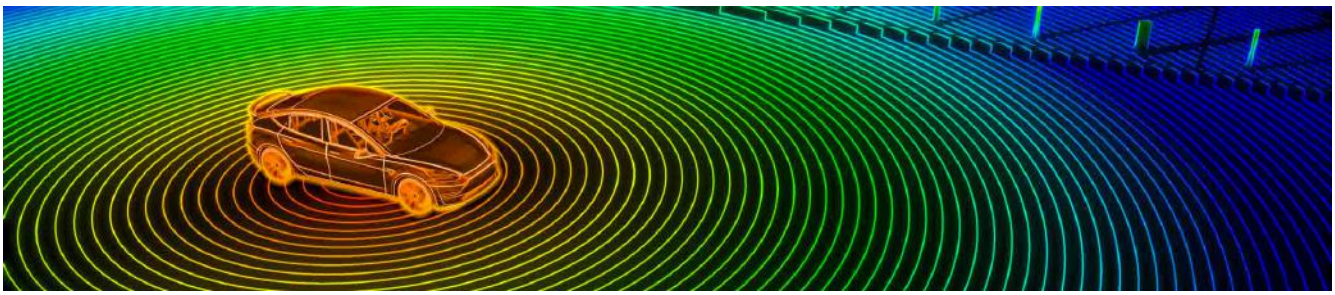
Zeekr showed off their robotaxi built for Waymo, following an agreement signed in late 2021. The vehicle starts with SEA-M, a refined version the Sustainable Experience Architecture (SEA) meant for “future mobility products”. The robotaxi network plans to deploy the purpose-built EVs in four US cities, including San Francisco, Phoenix, and Austin. Zeekr cars, equipped with driver assistance systems from Mobileye, will also be sold in Europe as early as S2-2023. The cars will be equipped with six EyeQ 5 chips from Mobileye for L^4 autonomous driving.

Ryder System and Kodiak Robotics recently unveiled their first collaborative venture: a truckport in Houston designed for autonomous trucks. Kodiak’s trucks currently operate with safety drivers on routes including Houston to Dallas and Houston to Oklahoma City. The company anticipates introducing its first driverless operations on the Dallas-Houston route later this year, utilizing the Ryder facility as a launch point.

The state of California plans the introduction of two key bills, part of the broader California Automotive Regulatory Standards (CARS) Package. This legislation aims to address both safety and employment regarding AV deployment. An upcoming assembly bill will require a trained human operator for AVs exceeding 10,000 lbs. Additionally, Senate Bill 915 mandates that AV companies secure local approval before launching operations in a municipality. The proliferation of AV might have an impact on employment. In California alone, around 200,000 professional drivers could be affected.

DVN-LIDAR DEEP DIVE

Docket in Progress: DVN-Lidar / Deep Dive 1(08-09 Apr.,at Stuttgart Radisson Blue)



The docket for the DVN-Lidar Deep Dive event on 8-9 April is under active development, and here's the current state of things:

08 April • Evening

19:00 Coctail & Welcome Dinner

09 April • Full Day

08:20 Opening of the Deep Dive

08:30-09:30 SESSION 1: APPLICATIONS 1
"Highway Pilot L3 & ADAS L2+"
Q&A

09:30-10:30 SESSION 2: TECHNOLOGY 1
"Scanning Technologies & Solid State"
Q&A

10:30-10:50 Coffee Break

13:10-14:00 SESSION 3: APPLICATIONS 2
"AD Regulation Status L2+ & L3"
Q&A

14:00-14:50 SESSION 4: TECHNOLOGY 2
"Sensors & Fusion for AVs: Lidar, Radar, IR"Q&A

14:50-15:10 Coffee Break

15:10-16:10 WORKING GROUPS & SHARING

16:10 Closure

16:15-17:45 Option 1: Ride & Drives
16:15-18:00 Option 2: Visit Porsche Museum (back to the Hotel à 18:00)