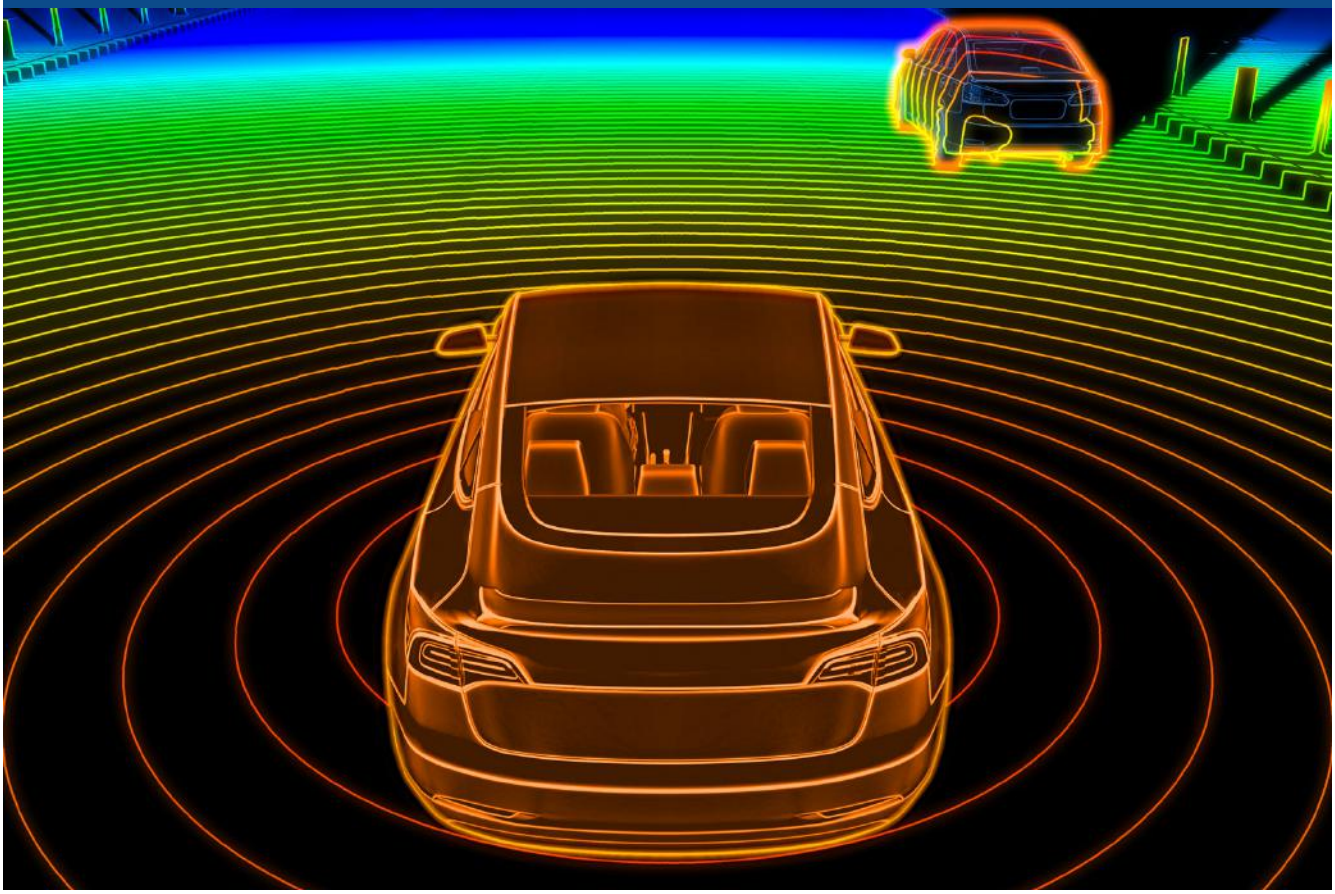
DVN
Lidar

# Monthly newsletter #21

DECEMBER 6, 2023



**EDITORIAL**

# 2024: The Year Lidar Breaks Out


With 160 participants, our 6th DVN Lidar conference was a great success. One key message: lidar is rapidly entering its mass-production era. Yole forecasts over a million units per year in 2024—read more about that in this week's interview—which is in line with the current volumes reported by major suppliers in China including Robosense, Innovusion, and Hesai; each of them is selling more than 20,000 sensors a month already.
It is clear that the leading application for lidar will be for advanced $L^{2+}$ ADAS features; $L^{3}$ autonomous driving will come later, for its deployment is quite a bit more difficult.
Another boost to the lidar market might come from American regulators, who are working on regulations to make AEB testing more stringent, especially in complete darkness as pedestrian fatalities due to traffic violence keep rising in the USA. You'll find detailed coverage of that development this week, as well.

We've got a full slate of **DVN-Lidar events in store for 2024; you'll want to save the dates:**

- Deep Dive 1 in Stuttgart (8-9 April)
- Deep Dive 2 in China (tbc, 11-12 June)
- Deep Dive 3 in Detroit (11-12 September)
- Lidar Conference in Wiesbaden (18-19 November)

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

All best,

**Alain Servel**

*DVN LIDAR ADVISOR*

LIDAR BUSINESS

# Lidar Business Newsbites

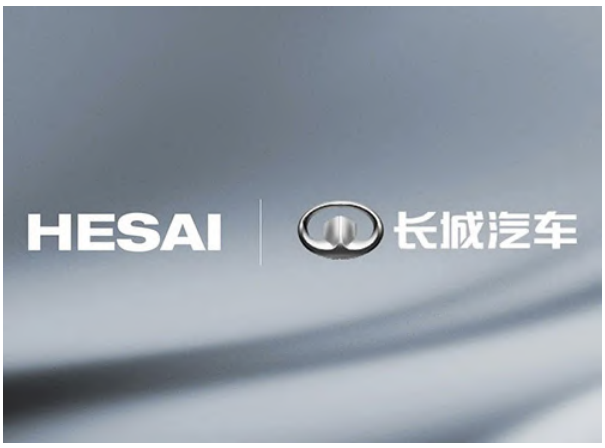

For the first nine months of 2023, the **cumulative NEPV** (new-energy passenger vehicle) registrations in China reached 4.9 million, with a 32.95-per-cent share of the overall PV market. Of these, 70 per cent are BEVs (Battery Electrical Vehicles), and 23 per cent are PHEVs. October registrations of some premium brands with advanced ADAS include BYD with 1.7 million; Tesla with 430,000; Li Auto with 245,000; Nio with 112,000; Geely with 87,000 and Geely-owned Zeekr with 70,000; Xpeng and Leapmotor with 80,000 each; and Changan's Deepal with 75,000.


In Q3-2023, **RoboSense** lidar deliveries reached nearly 60,000 units, with over 53,000 units being automotive ones. In the first three quarters of 2023, RoboSense has sold over 106,000 lidar units, of which over 93,000 for automotive. By October, RoboSense had been appointed as the lidar supplier for 61 vehicle models, having added three since June, demonstrating the company's sustained advancement in vehicle integration. During the same period, RoboSense supported 11 automotive manufacturers and tier-1 suppliers in realizing mass production for 19 vehicle models.

**DiDi Autonomous Driving** announced an investment exceeding C¥100m (€13m; $14m) to bolster **Benewake**'s development and mass application of robust perception lidar. Benewake's Yinglong lidar platform is based on 905-nm array transceivers; precise 2D scanning, and a custom SoC. It is claimed to work at up to 200 metres at 10-per-cent reflectivity, with 0.1° angular resolution and a 120° × 25.6° field of view.


**Innovusion** hit a delivery milestone of 200,000 automotive lidar units. The supplier has a lean production approach enhancing production line flexibility and efficiency, facilitating efficient production line implementation within 6 to 9 months. Innovusion has integrated their lidar into 9 mass-produced vehicle models, and cooperates with AVs developer such as TuSimple, Zhito Technology, Plus, and DeepWay.


**Stellantis** has bought a 21.26-per-cent stake in Leapmotor, for €1.5bn. The deal also outlines the formation of Leapmotor International, a 51/49 Stellantis-led joint venture with exclusive rights for the manufacture, export, and sale of Leapmotor's products outside Greater China.




**Hesai Technology** announced a strategic partnership with **Great Wall Motor** to integrate Hesai's AT128 long-range lidar into various GWM-made vehicles. Great Wall also will boost their in-house R&D capabilities to develop intelligent driving systems for more than 20 vehicle models. With partnerships established with over 14 mainstream automakers and tier-1s, Hesai has secured designated mass production projects for over 50 vehicle models so far.


**Hesai** is also collaborating with Leapmotor, whose upcoming mass-produced passenger vehicle will feature the AT128 as well. The AT128 long-range lidar has achieved monthly deliveries exceeding 20,000 units, and cumulative deliveries of over 130,000.


**Dongfeng Motor** showcased their new Voyah Free, equipped with Baidu Apollo's smart driving system. The Free, which went on sale this past August, is the first vehicle to be equipped with the Baidu Apollo advanced intelligent driving system. It offers features like Navigation on Autopilot (NOA), human-vehicle collaboration mapping, full-speed domain intelligent cruise control, automatic lane changes, and the world's first intelligent service area entry and exit assist functions. It also supports various parking modes, including efficient automated parking, remote control parking, and memory parking.

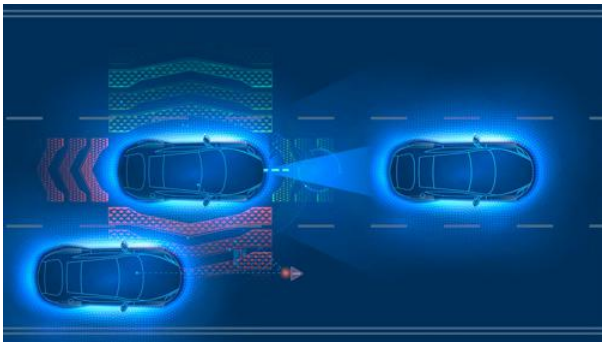

In Q3, **Hesai** achieved a revenue of C¥450m (€58.7m; $63.2m), up 33.5 per cent year-on-year. For the first three quarters, Hesai's cumulative revenue hit C¥1.32bn (€172m; $252m). In Q3, Hesai delivered 47,440 lidar units, of which 40,593 were designated for ADAS solutions. the total lidar deliveries for the first nine months of this year is 134,380, 85 per cent of which are ADAS lidar units. Hesai maintained positive operating cash flow for three consecutive quarters in 2023, reaching C¥47.6m (€6.2m; $9m).

**Polestar** is collaborating with **Luminar** and **Mobileye** to revolutionize the Polestar 4's safety and AD  features. The Polestar 4 will be the first production car to feature Mobileye Chauffeur, the integration of which includes three Mobileye EyeQ6 processors and a front-facing Luminar lidar, along with Mobileye's imaging radar.

**Aeva** is now officially the exclusive long-range lidar sensor supplier for May Mobility's global fleet of AVs. This multi-year agreement joins other May Mobility's collaborations, including their ties with Toyota, to illustrate their influence and capability in advancing AV technology.

**Nikon** has entered a multi-year production agreement to integrate **Aeva**'s lidar-on-chip technology into Nikon's industrial metrology and automated inspection products. As a result, industries such as automotive manufacturing, aerospace, and renewable energy can expect more advanced quality control and precision in measurements. Production is set to commence in 2024 with product rollout anticipated for 2025.


**Mobileye**'s financial performance soared in Q3 2023 as revenues achieved $530m. Net cash from operating activities totaled $285m for the first nine months ending 30 September. The SuperVision software's August release to Zeekr vehicles garnered positive responses. Progress was noted with key automaker prospects, including FAW and Polestar in Q3. The Zeekr software update was crucial in cementing the FAW partnership and accelerating other business discussions.



**Onsemi** will integrate their Hyperlux image sensor family into **Renesas**' R-Car V4x Platform. This collaboration is set to offer automotive vision systems of unparalleled quality to automakers and tier-1s, laying the groundwork for safer semi-autonomous driving.

LIDAR CONFERENCE

# Special Report: DVN Lidar Conference 2023


The DVN 2023 Lidar Conference—the 6th of its kind—was the place to be for a clear understanding of the latest market and technical developments in lidar technology.

With 160 attendees including automaker representatives (10 per cent of attendees); 20 exhibitors, and 31 speakers, the event was a grand success. Experts and providers in the lidar community talked and listened with each other, showed and told.

Olga Raz from Optica's comment is typical of feedback after the event: *"Thank you once again for the invitation to join this event. I found it to be excellent. Well curated, well executed, of very high quality, and, most importantly, truly beneficial to all the participants. I liked the format".*

Key takeaways:

- Market Growth is accelerating due to advanced ADAS features ($L^{2+}$). New applications will be related to urban automation, memorized parking aid, and other suchlike.
- High volumes are expected in the Chinese market, which is growing fast and will continue to grow next year. Some suppliers expect to deliver 500,000 lidars for ADAS applications next year and put in place fully automated production lines, which they can duplicate to follow the emerging demand.
- Lidar characteristics are different between the Chinese market ($L^{2+}$) and the European market ($L^{3}$ and other high-demand functions), which allows a lower price in China.
- Lidar integration is no longer the headache it once was; automakers now have plenty of alternatives including rooftop, behind the windshield, and integration in lamps. There is even a solution of collimated integration of radar, lidar, and LEDs all together in the headlamp.
- FMCW lidar will be available soon on the market with higher performance (and cost) than pulsed lidars.

A detailed report will be sent in December to the attendees, and presentations to the members and speakers. We give great thanks to all the speakers who contributed to the conference and allowed us to have a clear view of the status and directions of evolving lidar technologies and market conditions.

INTERVIEW

# Interview: Yole's Pierrick Boulay on Car Lidar Market Trends

**Pierrick Boulay** is a Senior Technology and Market Analyst in the Photonics and Sensing Division at Yole Intelligence. He works in the fields of solid-state lighting, carrying out technical, economic, and marketing analyses. In addition, he leads the automotive activities within the company.

Boulay has authored several reports and custom analyses on topics such as vehicle lighting, lidar, sensing for ADAS vehicles, and VCSELs. Prior to Yole, he developed his knowledge at a variety of companies, primarily in R&D departments on LED lighting applications.

He holds a Master of Science in Electronics degree from ESEO (Angers, France).

## DVN-Lidar: Yole is a leading market research and strategy consultancy with solid understanding of the lidar market and technologies. What can you tell us about your departments?

**Pierrick Boulay**: Indeed, Yole Group is a consulting firm specializing in the strategic analysis of markets, the supply chain, and technological developments related to the semiconductor and adjacent industries. Benefiting from direct access to major players in the field of semiconductors and the multidisciplinary profile, including the scientific, technical, and market orientation of its analysts, the company supports its clients in understanding markets, the evolution of technology, and their commercialization.

At Yole Intelligence and Yole SystemPlus, we have been following the lidar market and related technical innovations since 2017. Since then, we have published numerous market and technology reports and developed an impressive collection of lidar teardowns. All analyses are available on our corporate website. Our group today has an in-depth understanding of the technological choices made by the leading automotive companies and the market changes that drove them.

## DVN-L: Could you tell us more about the current state of the automotive lidar market? Which countries are leading?

**P.B.:** The lidar market is at a crossroads. Indeed, 2022 was the first year that the lidar market for passenger cars exceeded the one for robotaxis. In the beginning, only Audi had multiple car models implementing lidar. In 2021, at Yole Group, we saw more OEMs had implemented lidar, like Honda, Lucid Motors, Lexus, and Mercedes, among a few others, but it was limited to high-end cars, mostly from the E and F segments, and therefore low volume. It was only in 2022 that volume started to grow significantly with a strong push from Chinese OEMs with cars in the D segment. That means more affordable cars, more volume, and, therefore, a lidar market that is taking off. In 2022, according to the lidar 2023 report, experts estimated that the lidar market for passenger cars was valued at $169m.

In 2022, 100 per cent of the cars released were from Chinese OEMs. Since 2018, 61 per cent of the cars released with lidar were from Chinese OEMs. So, it is quite clear that China is leading the race in terms of implementation. Among the others, 25% of cars were released by European OEMs, 11 per cent  from Japanese OEMs, and 3 per cent from U.S. OEMs.

## DVN: What is your volume forecast for 2028?

**P.B.:** In 2028, the lidar market is forecasted to be $3.9bn, and will still be driven by Chinese OEMs. Our analysts are monitoring the different design wins, and between 2023 and 2025, we have counted more than 120 cars embedding lidar(s) to be released. Among them, more than 100 will be from Chinese OEMs. This clearly shows that there are currently two markets for lidar: the Chinese market and the rest of the world. They have different dynamics. In China, OEMs have already made the transition from ICE to EV cars, and this transition started 20 years ago. So, now OEMs can focus on implementing more features for ADAS and autonomy. The high number of OEMs implementing lidar leads to higher volumes and, therefore, a lower lidar price for the OEM. For the rest of the world, the transition from ICE to EV is just starting, and OEMs are focusing most of their resources on this transition. It is even more obvious in Europe, where in 2035, only battery-electric vehicles will be allowed to be sold. This is not preventing European OEMs developing automated driving features, but this is limited to high-end cars like the Mercedes S-Class or EQS, the BMW 7 series, or the Volvo EX90. When this transition is more advanced, more cars with lidars from European OEMs could be expected.


## DVN-L: What are the main applications today? Do you see the applications changing in the next five years? Is Autonomous Driving expected to be the main application?

**P.B.:** Currently, most of the applications are related to automated driving on highways. First eyes-off applications in Germany and a few states in the United States will allow the car to drive by itself on highways up to 60 km/h. The speed limit is expected to increase to 130 km/h with the release of a new generation of lidars like the Valeo Scala 3. In China, OEMs are developing Navigate on Autopilot (NOA) features so that the car can complete lane changes and enter and exit ramp junctions, but only on highways. But, due to a lack of regulations, all these cars are still considered hands-off, and the driver must remain alert on the driving task.

In the next five years, other applications related to valet parking and possibly ADAS applications like the AEB functionality should be seen. Currently, AEB relies mainly on the forward ADAS camera and radar. This combination works well in good lighting conditions and in straight lines, but when conditions deteriorate with darkness, children, and curves, this system performs poorly. This is why the NHTSA in the United States is working on regulations to make AEB testing more stringent, with testing in complete darkness, amongst others. If this new AEB regulation is approved, this could mean the use of an additional sensor for OEMs. In this case, that could be an opportunity for lidar, but there will also be competition with thermal cameras or gated imaging cameras that are much cheaper.

## DVN-L: What types of lidars will launch in the next five years? What technologies will coexist?

**P.B.:** Long-range lidars used to be quite bulky, so they were implemented in the front grille or on the roof. The next generation will be thinner allowing them to be positioned behind the windshield, which also solves cleaning and thermal management issues. To enable this, windshield manufacturers had to improve their product with coatings to make the glass transparent enough to be used with 905- or 1,550-nm lidars.

Short-range lidars were virtually not used by OEMs for multiple reasons: lack of a real use case, high price, and limited performance. In 2024, new short-range lidars should be seen based on a combination of VCSELs and SPADs that will enable better performance and lower cost. The use case is not totally clear yet, but they could be used for lane change assist and parking applications.

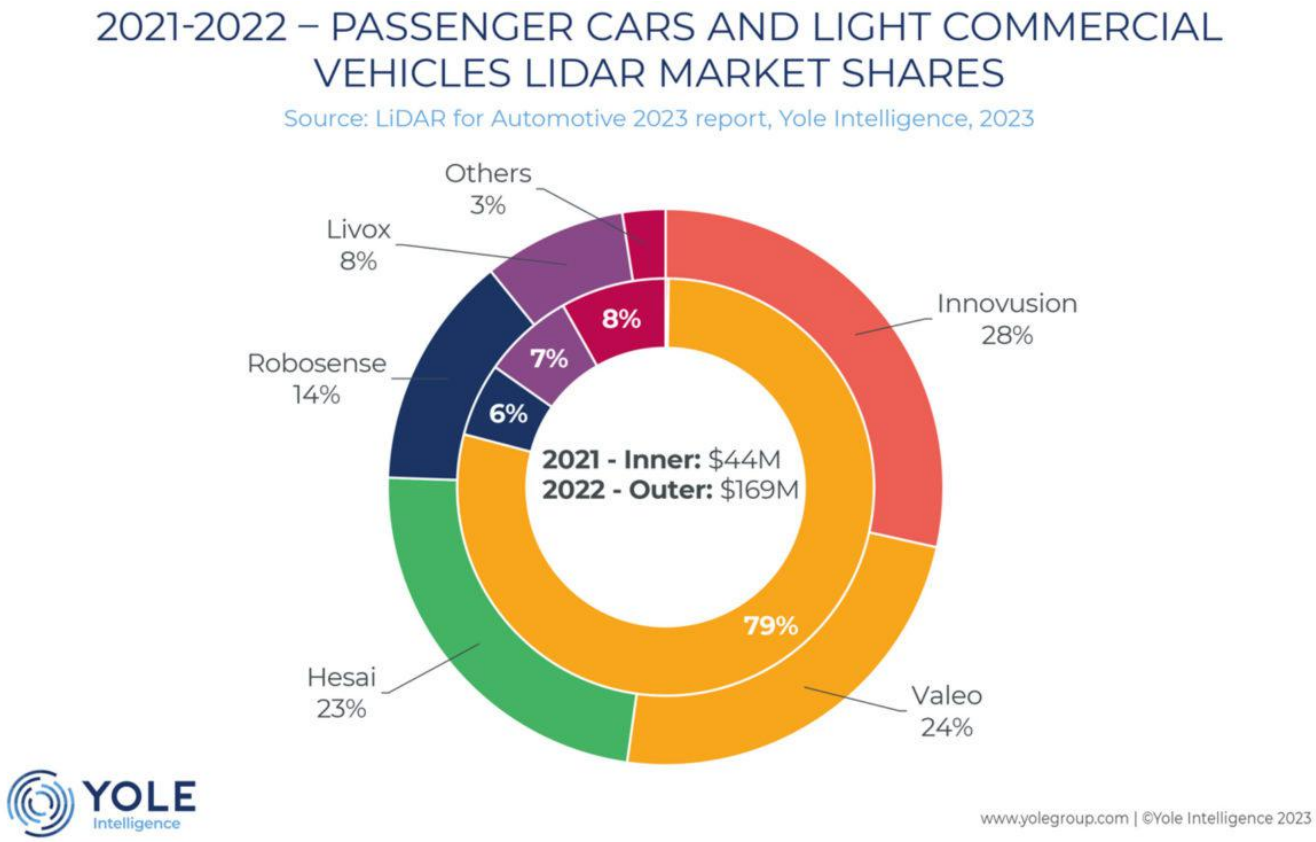
Regarding technology, time-of-flight lidars at 905 nm are expected to dominate in the next five years due to lower cost and higher availability of components. The performance of these components is still increasing. Multi-junction VCSELs allow a higher output power while retaining the small die size. On the receiver side, SPADs and SiPMs are much more sensitive than APDs, and the photon detection efficiency (PDE) is expected to reach 30-35 per cent in the near future. So, 905 nm will dominate, but 1,550 nm lidar will also be used, though in lower volumes. 1,550 nm components are much more expensive, and the number of suppliers is limited. One of the consequences is that Luminar solved this issue by acquiring their suppliers so that they are now vertically integrated, can secure their production, and can work on improving the performance of these devices.

## DVN-L: What are your thoughts on FMCW over the next five years?

**P.B.:** The feedback from lidar players working on FMCW technology is that they expect initial volume production not before 2027-2028. FMCW is seen as a very promising technology enabling the measurement of the velocity of objects instantly in contrast to time-of-flight. It is also more robust and resistant to interference from other lidars. But, before we see FMCW lidars on the road, the cost of the laser, the optics, and the electronics for calculations will need to fall drastically. FMCW lidars are based on Silicon Photonics technology, which is still emerging. Even in 2028, Silicon Photonics revenue will be quite limited (~$600M) and driven by datacom and telecom applications. Once these applications are more mature, with more players and sufficient manufacturing capacity, we could see FMCW lidars in large volumes.

## DVN-L: Who are the main lidar suppliers, as you see it?

**P.B.:** In 2022, the lidar market leader was Innovusion, followed by Valeo, Hesai, and RoboSense. These four players generated 89 per cent of the revenue in 2022. Innovusion leads the market due to its partnership with Nio, which has many car models using lidar. Yole Group estimated that more than 56,000 lidars from Innovusion were on the roads in 2022. As the industry is quite young and evolving rapidly, analysts expect that these rankings will change in 2023, with Hesai taking the lead due to its large number of partnerships with Chinese OEMs.




## DVN-L: What is slowing growth? Where is there significant cost reduction to be had?

**P.B.:** There are multiple roadblocks preventing the rapid deployment of lidar. Performance was a limiting factor, but with the arrival of the next generation in 2024 – like the Valeo Scala 3 – the range and resolution should be good enough for automotive applications. Once this level of performance is achieved, lidar manufacturers will be able to focus on cost reduction. Compared to cameras and radars, the cost of a lidar is an order of magnitude higher. So, this is still a significant roadblock for OEMs, explaining why lidars are only implemented in high-end cars. The cost of processors for lidar can easily reach more than $80. FPGAs are widely used in lidar, but once developed, an ASIC could reduce the cost. However, it comes with high upfront costs. Depending on the wavelength, the cost of the light source can also be problematic. Photodetectors are also expensive.

When opening a lidar, you see multiple boards inside, easily five or six, indicating that lidars are still not mature and optimization is needed to reduce the cost. This goes along with the automatization of production lines to reduce the number of manual operations.

Regulation is another roadblock as eyes-off driving is allowed only in a few countries: Japan, Germany, the United Kingdom, and a few states in the United States. Regulations allowing automated driving in more countries that clearly define the responsibility of the driver and the OEM (when driving in automated mode) are necessary. Can a driver play Tetris while the car is driving itself, or should he remain alert? OEMs will have to be clear about what can be done or not and not over-promising as Tesla did in the past.

## DVN-L: Do you expect a reduction in the number of competitors?

**P.B.:** Yes, it is clear that a reduction in the number of competitors in the coming years can be expected. If we compare the lidar market with more mature markets like camera and radar, we see these markets are driven by four or five players having 75 per cent of the market with few other players. Yole Group expects a similar pattern in the lidar market. There are currently around 20 lidar players in or entering the automotive market. Not all of them will succeed. Some will die, others will be acquired, or change their focus to other markets than automotive.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

# NHTSA Proposes to Boost Pedestrian Safety—Night & Day


With 75 per cent of accidents with pedestrians happening at night, there is a need to improve the current AEB systems mostly designed for daylight conditions. Despite improvements in cameras and algorithms, NHTSA's proposal is expected to result in future vehicles using a wider range of sensors.

In a recent white paper, VSI-Labs senior partner and principal analyst Egil Juliussen said meeting the requirements could drive demand for infrared cameras, 4D imaging radar and **lower-cost solid-state lidar**.

According to NHTSA's proposal, within three years of the final rule, light-duty vehicles with a gross weight rating of up to 4,536 kg will have to meet the following standards:

- FCW and AEB must be active at 10km/h or greater to ensure some level of accident mitigation is always present. There are no specific deceleration or crash avoidance criteria if traveling at speeds higher than the proposal's tests, but compliance will be enforced by post-crash investigations.

- AEB must prevent collisions with a lead vehicle that is stopped, slowing or moving more slowly. In the toughest scenarios the subject vehicle is traveling at up to 100 km/h toward a target which is either stationary or moving at 20 km/h, and testing will assess how responses are affected by manual brake inputs.

- Pedestrian AEB must prevent collisions with a mannequin, which can be stationary, crossing from the left or right, and following the path of the vehicle at up to 65 km/h. Tests will be done in daylight and in darkness, the latter using low- and high-beam headlights. Manufacturers will have an extra 12 months to meet low-beam collision avoidance requirements.

- AEB must avoid false positives under two scenarios: driving over a steel trench plate (commonly used in roadworks) and through a 4.5-m gap between two stopped cars. The maximum permitted brake response is 0.25*g* of deceleration force. Vehicles must also issue a visual warning to drivers if the system is not working properly, such as if sensors are saturated by glare or obstructed by snow or fog.

DVN comment

**Different technologies will compete to improve the detection of pedestrians at night: radar, IR sensors, short range lidars. Cameras alone cann't do the job!**

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

# L3 Automated Driving in BMW 7: Coming Next Spring

Level 3 highly automated driving, which allows drivers to take their hands off the steering wheel and divert their attention away from the road, will soon be available, in Germany only, as a €6,000 option in the new BMW 7 Series (except the i7 eDrive50 and i7 M70 xDrive), with new-car installations beginning next March.

This technology allows drivers to redirect their focus to other in-vehicle activities when travelling at up to 60 km/h (37 mph) on motorways with structurally separated carriageways. This is the first system of its kind that can also be used in the dark.

The BMW Highway Assistant already offers a strong $L^2$ partially-automated driving function in all new 5 Series models. The package also includes a unique feature in the form of the Active Lane Change Assistant with eye confirmation. When travelling at up to 130 km/h (81 mph), this additional function of the Steering and Lane Control Assistant can take control over the car's speed, the distance to the vehicle in front and the car's steering.

Whenever the BMW Highway Assistant is in use, drivers must watch what is happening on the road and be able to take over the task of driving again at all times. This is continuously monitored using an intelligent attentiveness camera.

Symbols appear on the display behind the steering wheel as appropriate to indicate whether the Personal Pilot $L^3$ is available. It is activated and deactivated by a button on the steering wheel. When the function is being used, the customer still has to be ready to resume the task of driving at any time

The live HD map with precise routes is permanently aligned with extremely accurate GPS location-finding and works with 360° sensors to ensure exact positioning and monitoring of the area around the vehicle. The live HD map is always up to the minute thanks to regular updates. In the new 7 Series, this functionality is underpinned technologically by a new software stack, a powerful computing platform and a 5G uplink to the BMW Cloud.

DVN comment

**After Mercedes, BMW is launching their Traffic Jam Pilot feature in combination with advanced features in the ADAS mode for highway driving.**

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

# AEye's New In-Cabin Lidar is Performant, Design-Friendly

AEye's 4Sight Flex is an ultra-compact, highly performant reference design for automotive in-cabin lidars. It is energy-efficient, too, enabling the next wave of $L^{2+}$, $L^{3}$, and $L^{4}$ autonomy and safety features to be integrated in-cabin.

The 4Sight Flex optimizes for various integration scenarios, including the windshield and roof, allowing automakerss to deliver maximum safety to customers while preserving the aesthetic appeal of their cars. With 4Sight Flex, AEye is delivering what the market demands: exceptional lidar performance together with the option for a more integrated design in the automaker's chosen location.

It is believed to be the only 1,550-nm lidar capable of in-cabin integration. It has a 120°H × 30°V view field, with ultrahigh resolution of down to 0.05° and long-range detection of up to 275 metres at 10-per-cent reflectivity, with about half the size and down to 40 per cent lesspower consumption compared to AEye’s first-generation design.

The4Sight Flex also offers what AEye says is the least-technically-risky solution at one of the lowest volume costs in the industry. As they scale production for automotive volumes, they anticipate an additional 10 to 20 per cent component cost reduction compared to the current generation, making this design even more affordable.

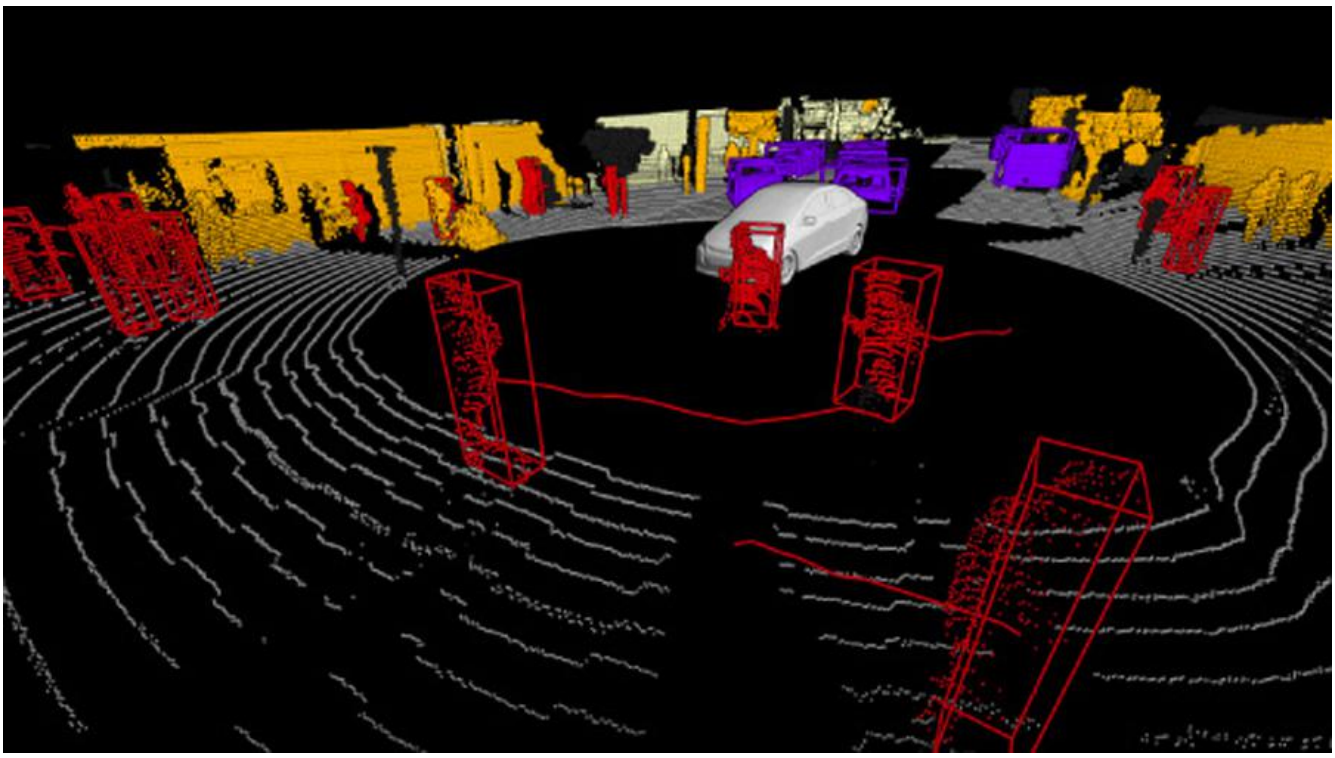
The new design takes advantage of the 4Sight Intelligent Sensing Platform, allowing for highly programmable lidar performance that meets the performance requirements of all driving environments – highway, urban, and suburban. The 4Sight Flex, with availability slated to begin in 2024, can also be reconfigured through software, allowing automakers to push new capabilities to the lidar sensors via OTA updates.

DVN comment

Aeye is following the trend to integrate lidars behind the windshield, to our knowledge, this is the first 1,550-nm lidar available for in-cabin integration.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

# Innovusion, Exwayz Partner for Advanced Lidar Tech in Europe



Innovusion and Exwayz, a software company developing positioning solutions based on lidar Simultaneous Localization and Mapping (SLAM) technology, have agreed a partnership to provide SLAM technology to clients across Europe.

The ultralong-range lidar sensor greatly benefits the Exwayz SLAM solution. Each lidar frame fed into the Exwayz solution contains accurate, long-distance features and dense ground measurements that help stabilize the SLAM system, even in featureless environments.

The Innovusion Falcon has been a central component of the Aquila system for eight Nio models, including the ET7, ES7, and ET5, since 2022. Over 150,000 units are currently in use. It is said to boast an 'impressive' per-point precision, a 25° × 120° view field, and frame rates up to 30 fps. Extensive range is another standout feature, enabling it to capture high structures while minimizing drift, which is a significant advantage over sensors with shorter ranges.  The Falcon's extended range also holds immense potential for enhancing SLAM technology in environments that are historically challenging to most SLAM solutions, such as tunnels and other auto similar places. This partnership represents an opportunity to accelerate SLAM convergence and expand the capabilities of autonomous navigation and mapping solutions.

Exwayz SLAM technology is built upon proprietary innovations in computer science and 3D vision. It is the first reliable embedded software solution capable of achieving centimeter-precise positioning for mobile robots through real-time 3D lidar data processing

DVN comment

Exwayz SLAM will highly benefit from a permanent and accurate scanning from the Innovusion Lidar. This is a key-function for the future autonomous driving features to position the car on the street.

## LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

# Magna's New Front Camera Module Commercialized

Magna announced the production start of their innovative Gen5 front camera module system for a European automaker. The high-volume business award will support various platforms across regions and vehicle models over the next few years. Magna leveraged their market-leading camera expertise and global manufacturing processes to develop a scalable, one-box front camera module for the automaker.

The complete forward-facing camera system features a wide field of view with opening angles of 120°H × 48°V. This allows for both long-range perception of obstacles exceeding 160 metres in front of the vehicle, and detection of side objects, such as traffic lights, emergency vehicles and cut-in vehicles. The camera offers 8-megapixel resolution, a 36-fps frame rate, and a full colour image. The microcontroller is scalable for sensor fusion with up to five radars.

Magna Electronics Senior VP Sharath Reddy says, "We are dedicated to providing cutting-edge solutions and innovations that prioritize safety for all who share the road. With our latest generation front camera module system, we are advancing driver assistance by offering essential features that keep drivers engaged and provide real-time road insights, equipping them with a comprehensive understanding of their surroundings".

The system offers features including:

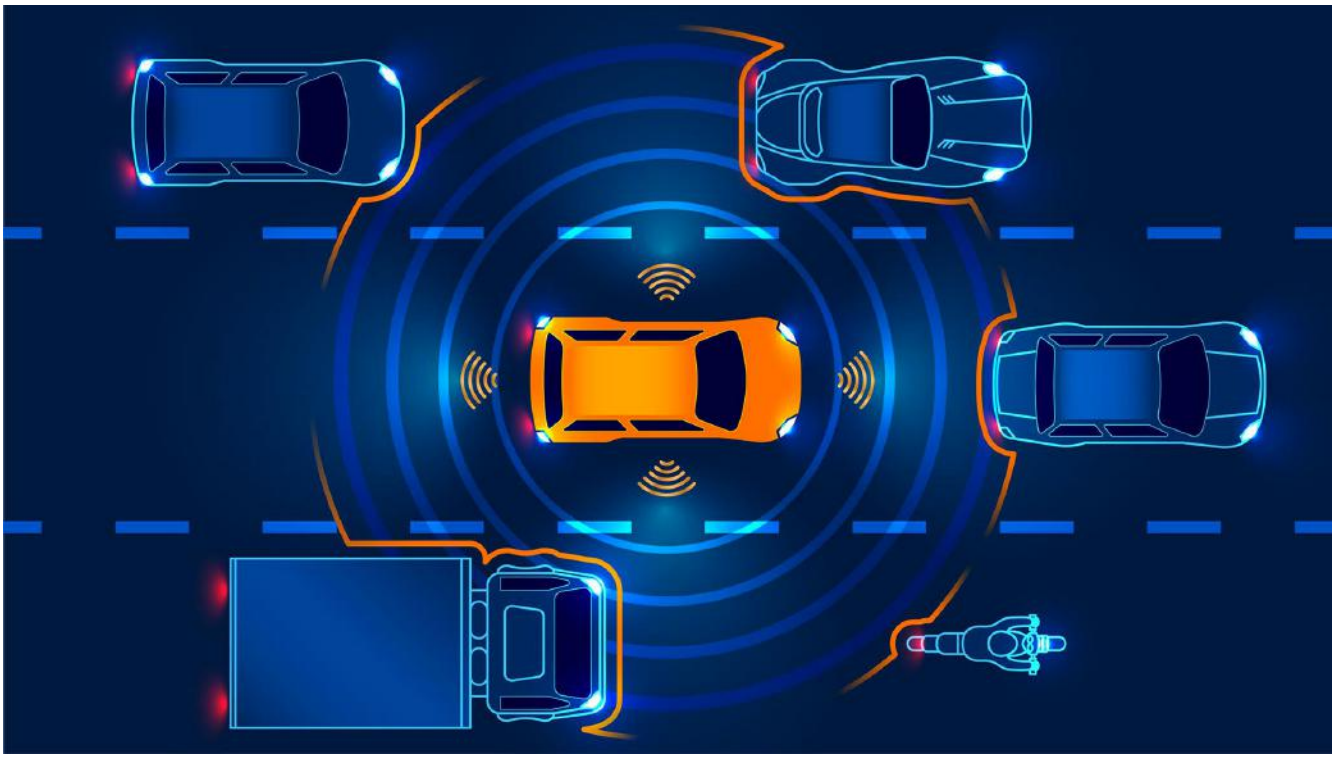
- Trained Park Assist (TPA), a parking automation comfort feature that provides the driver with an option to park the vehicle automatically with a previously learned “park-in” or “park-out” trajectory.
- Environmental Condition Recognition (ECR) that classifies the current condition of road surfaces ahead with respect to wetness or snow coverage for piloted driving functions to control the vehicle.
- Monocular Scene Reconstruction (MSR) which detects the transition of drivable to non-drivable areas. For example, asphalt to grass transitions, construction site delimiters and many more.
- Hazard Detection (HZD), noticing static obstacles on the road upfront to avoid collisions.

DVN comment

**This new camera is not a camera but also an ECU to operate advanced ADAS features. This is also a low cost system since you connect directly the radars to the front camera ECU, and do not need any separate ECU to do the job.**

AUTOMATED DRIVING

# AD Newsbites



The **German automotive industry** has recently achieved a significant milestone in automated driving. After a four-year collaborative effort involving 21 partners, the industry has unveiled the world's first framework for validating and verifying safety standards for AVs in urban settings. This initiative, backed by the German Federal Ministry for Economic Affairs and Climate Action. The consortium has developed a comprehensive model comprising procedures, methods, and tools for security argumentation, ensuring that vehicles meet the highest safety standards before hitting the roads.

China’s Ministry of Industry and Information Technology, Ministry of Public Security, Ministry of Housing and Urban-Rural Development, and Ministry of Transport jointly released a notice, titled "**Notice on Conducting Pilot Program for Intelligent Connected Vehicles."** The four departments will select intelligent connected vehicle products equipped with autonomous driving capabilities ($L^{3-4}$), suitable for mass production, to initiate a pilot access phase. The notice explicitly designates accident responsibilities concerning autonomous driving vehicles: when the autonomous driving function is active, the responsibility lies with the intelligent connected vehicle itself; if the function is inactive, the current regulations for responsibility apply, holding the driver or other liable parties accountable.

**Continental** Automotive has won a CES 2024 Innovation Award for their Radar Vision Parking technology. Radar Vision Parking combines radars and cameras for a 360° view around the vehicle, enabling early parking spot detection and precise maneuvering.


**WeRide** was granted permission to trial commercial unmanned robotaxi service with only remote monitoring in Beijing (BJHAD area). WeRide's service covers 242 pickup and dropoff points, within the Beijing Yizhuang Area. The service accommodates 1-3 passengers per car and operates from 9 AM to 5 PM. Previously, WeRide launched robotaxi services in Nov. 2021 on Abu Dhabi's Yas and Saadiyat Islands, garnering nearly 20,000 customers.


**Zeekr** has begun offering a highway NZP assistant driving system in Guangzhou, Shenzhen, and Ningbo. The NZP system is available on the Zeekr 009 and 001 models, and is already available in Shanghai and Hangzhou. The company is expected to roll out the system in a total of 17 cities by the end of the year. NZP is a map-based assisted driving system, which can navigate autonomously on and off highway ramps, realize active lane-change overtaking, change lanes according to the navigation, autonomously drive pass ramps, correctly select roads at a fork, and make detours in case of construction.

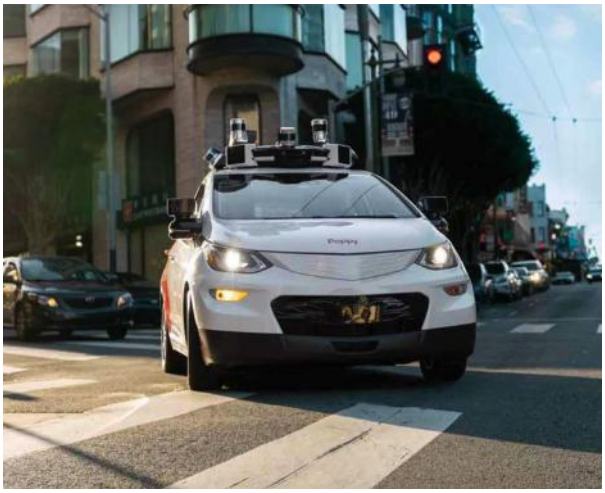

**TuSimple** announced the successful completion of their $L^4$ autonomous truck testing on the 270-km Tokyo-Nagoya expressway in Japan, after 41,605 km of driving. The test route includes tunnel drives exceeding 5 km. After the success of on-road testing, TuSimple's Japan team plans to increase the number of test trucks and expand the test route from Tokyo to Osaka by 2024. Previously, TuSimple had accomplished the world's first fully unmanned testing of autonomous heavy-duty trucks in the United States.

**Hyundai Motor** Group and **Motional**, an AV tech supplier, have innaugurated the Hyundai Motor Group Innovation Center in Singapore (HMGICS). This facility is the birthplace of the IONIQ 5 robotaxi, an AEV slated for first deployment at Motional's commercial operations in the United States, set to begin in 2024.

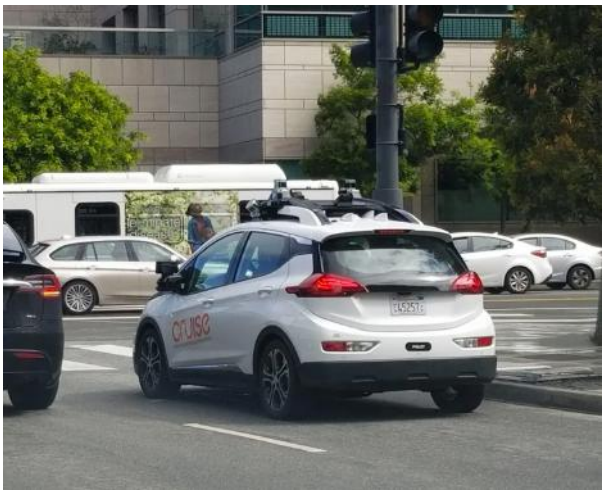
The **Teamsters** Union in New York has taken a firm stance against **Waymo**, Google's AV subsidiary, who plan to expand their robotaxi operations in New York. Citing safety concerns and job losses, the union is actively urging state legislators to prevent these driverless vehicles from operating on public roads. Teamsters Joint Council 16 President Thomas Gesualdi expressed concerns over the safety of driverless vehicles and their impact on public safety.


**The British Government** has introduced new legislation to regulate the rollout of self-driving vehicles on UK roads. The Automated Vehicles Bill is one of the most comprehensive legal frameworks of its kind in the world, and it puts safety at its core. It will require all self-driving vehicles to undergo robust safety testing before they are permitted to operate. The bill will also create a new legal entity, the Authorised Self-Driving Entity, which will be responsible for the behavior of self-driving vehicles when they are in self-driving mode.

**Geely Holding Group** and **Baidu** have jointly launched the JiYue Robocar 01, an AI-laced EV.  The unveiling took place at a branded event in Shanghai. This car features the world's first consumer accessibility to Baidu's Apollo full suite of $L^4$ ADsolutions. Robo Drive Max subscription offers evolving intelligent functions like PPA navigation assistance and autonomous valet parking, expanding coverage in China by 2024.



**Cruise** executives are taking a measured business approach that preserves cash and improves safety culture in an attempt to put GM's troubled autonomous vehicle subsidiary on the right path. The first steps were laid out in an internal email sent by Mo Elshenawy, who is replacing cofounder and former CEO Kyle Vogt.  That means focusing on their current robotaxi platform (the Chevy Bolt AV) and pausing production of the forthcoming Origin. Elshenawy also said the company will relaunch in just one city at first. That's a departure from the aggressive multi-city launch strategy Cruise and GM focused on in 2023.

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**Aurora Innovation** has unveiled the pioneering commercial-ready lane for autonomous trucks, connecting Dallas and Houston, Texas. With the introduction of this corridor, Aurora establishes commercially-prepared terminals at both ends, emphasizing the importance of the I-45 route that handles nearly half of Texas' truck freight.


**Iveco** and **Plus**, an AD software company, have announced an innovative pilot program in Germany. Partnering with Europe's largest drugstore chain, DM-Drogerie Markt, and DSV, a global transport and logistics provider, the pilot marks the first customer use of highly-automated trucks in Germany. Slated to begin in the first half of 2024, this pilot will see Iveco trucks equipped with Plus technology transporting goods across the Baden-Württemberg-Hessen region.


The **ATLAS** $L^4$ research and development project has made significant strides in advancing autonomous trucking on German highways. This collaborative initiative involves industry giants like MAN, Knorr-Bremse, and Bosch, alongside several renowned academic and research institutions. Their efforts are focused on pioneering $L^4$ automated transport between logistics centers. The control centre for overseeing these autonomous vehicles was effectively launched in September 2023.

**Pony.ai** secured the first license for autonomous $L^4$ truck platooning testing in Guangzhou. Platooning operates in a "1+N" formation, with one navigator autonomous truck guiding multiple $L^4$ autonomous trucks along roadways. Five autonomous trucks have been granted licenses for platooning tests. In September 2023, Pony received a notice for the demonstration application of intelligent-connected heavy-duty trucks in Beijing's intelligent-connected vehicle policy pilot zone.