DVN
Lidar

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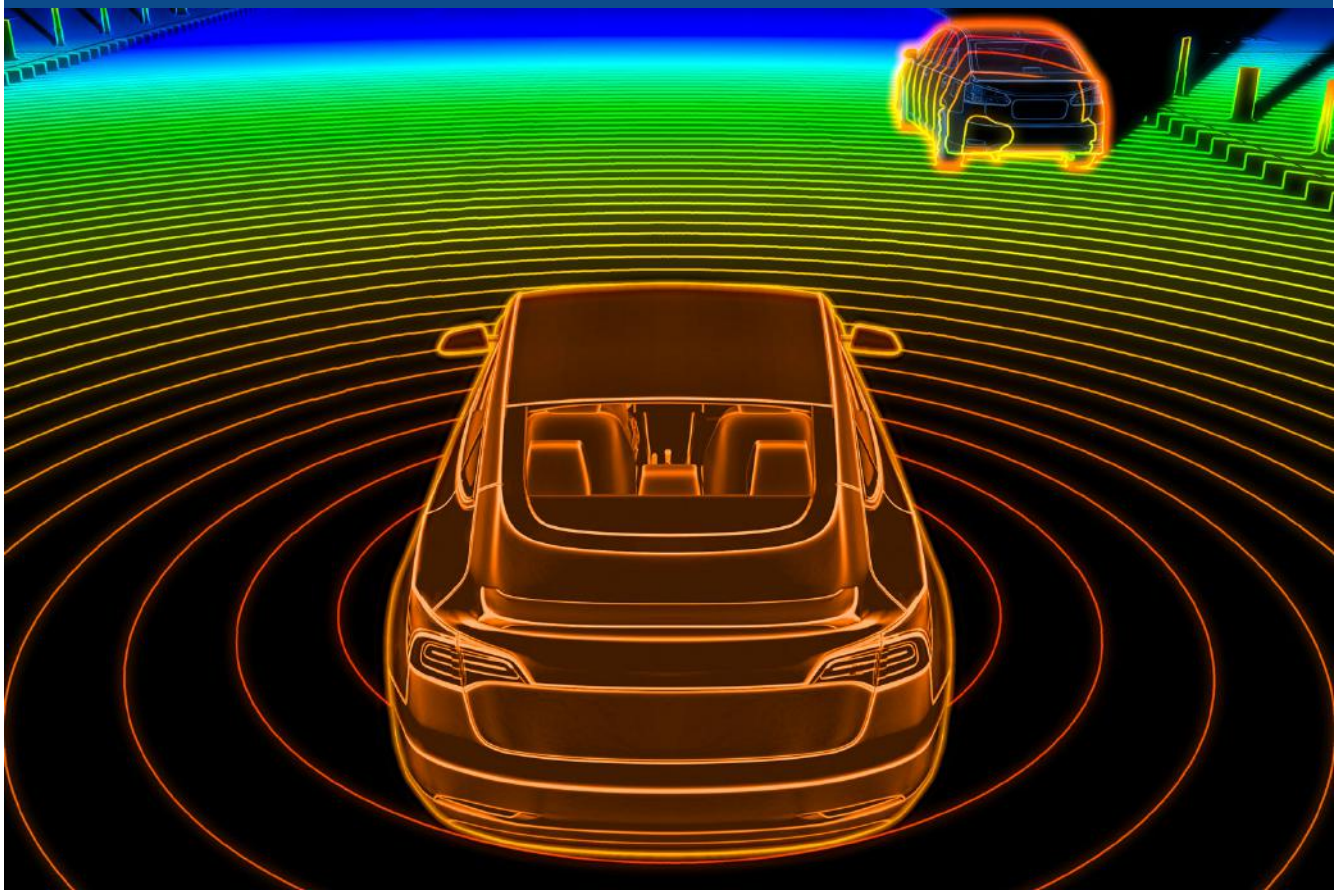


EDITORIAL

Suppliers Support Lidar Location Within Windshield

The lidar market is still picking up speed. We see lidar integration behind the windshield getting momentum as ultra-slim lidars are now offered by multiple suppliers. That makes it easy to keep the lidar's view clear with the existing windshield wiper-washer system.

And the first technical standard related to lidar performance assessment was published last month. This is a major step for the automotive industry to assess and compare the performance between multiple lidar technologies and suppliers. This week we look at this increasingly major trend from a variety of angles.

We also bring you a wide-ranging interview with the fast-moving RoboSense company, founded about nine years ago by a group of PhDs from Harbin Institute of Technology. Now they're winning major supply contracts with Chinese and international automakers.

Be sure and save the dates for these forthcoming high-content, high-value DVN Lidar events:

- Deep Dive II (Europe): 5-6 June at Dorint Pallas Wiesbaden in Germany
- DVN-L Deep Dive III (USA): 29-30 August in San Francisco Bay area
- DVN-L Conference (Europe): 29-30 November at Dorint Pallas Wiesbaden in Germany

We're ever so glad you're here with us in the DVN lidar community. Enjoy this 14th newsletter!

All best,

Alain Servel

DVN LIDAR SENIOR ADVISOR

INTERVIEW

Interview: Stella Xie, RoboSense Head of Strategic Planning

Stella Xie joined RoboSense in 2019 and is currently responsible for the company's product strategic development planning and intellectual property management.

From 2016 to 2019, he worked at DJI as intellectual property manager, with a leadership role in the research and development of lidar; chips; deep learning algorithms; flight controllers; navigation; and other technologies, and responsible for patent planning; mining, and application as well as participating in industry standard tracking. From 2012 to 2016, he was a patent engineer at Huawei.

He earned a bachelor's degree in applied chemistry and master's degree in optics from Peking University, and master's degree in intellectual property from Shenzhen University. He graciously shared his perspective and views with us:

DVN: Robosense, founded in 2014, is now a well-known lidar company. What more can you tell us?

Xie: RoboSense was founded with the mission of enabling robots to have perception capabilities superior to humans. We are always cooperating with global partners to explore environment perception solutions together. By the end of 2022, our staff reached over 1,600, and lidar-related global patents over 1,000. Since establishment, RoboSense always follow the principle of simultaneous development of hardware products together with software, leading the lidar transformation from precision instruments to automotive pre-installation mass production.

In 2016, RoboSense achieved the mass production of R-platform mechanical lidar, and simultaneously started to develop the M-series lidar based on 2D MEMS scanning. With the second-generation smart solid-state lidar RS-lidar-M1, Robosense took the lead in realizing the world's-first SOP for MEMS lidar in June 2021. The success of M series lidar became a milestone, representing the lidar industry began entering large-scale mass production.

In November 2022, based on self-developed chips and a new technology platform, RoboSense released the solid-state blind spot lidar, RS-lidar-E1, which is the first product of the RoboSense E platform and the last piece of the puzzle for automotive-grade, mass-production lidar.

RoboSense has become the lidar company winning most design wins worldwide—over 50 with BYD; FAW; GAC; Xpeng; Geely; Great Wall, and other car manufacturers, and we've built the world's first and only automotive lidar laboratory accredited by CNAS, as well as an intelligent manufacturing system with top efficiency of a lidar unit built in 12 seconds.

DVN: You're marketing automotive MEMS lidars with no moving parts. What makes them better?

Xie: M series lidar adopts two-dimensional MEMS intelligent chip scanning architecture, with advantages including high performance; simplified architecture; high reliability; and high scalability, all of which go toward large-scale mass production.

The M series is the most fully tested and verified lidar in industry; it's passed dozens of strict automotive-level test verifications. Its core component MEMS galvanometer module is currently the world's only AEC-Q100 certified item for lidar products.

It has a unique intelligent "gaze" function, which can be applied to different driving scenarios such as high-speed and urban areas. In this mode, the vertical resolution of the ROI (region of interest) area at center of the field of view can be dynamically increased from 0.2° to 0.1° or even higher, doubling the imaging density of obstacle point clouds, greatly improving the perception ability for intelligent driving systems in various scenes.

And the M series can achieve seamless iterative upgrades as long as the size, installation specifications, connectors and communication protocols are consistent.

Since July 2020, RoboSense has received design wins from nearly 20 leading automakers worldwide totalling over 50 models, including BYD; GAC AION; FAW Hongqi; FAW Jiefang; Chery Automobile; Great Wall; Xpeng; SAIC IM; SAIC Rising; Zeekr; Lynk & Co; Lotus, and Lucid, for passenger cars and commercial vehicles.

DVN: What can you tell us about the specifications of your lidars?

Xie: The wavelength of the M series is 905nm. Compared with 1550nm lasers, 905nm lasers have great advantages in power consumption; cost; efficiency; heat generation, and manufacturability for large-scale applications. In addition, through continuous research and development on 905nm, RoboSense found the ranging performance of 905nm had a much higher potential than expected.

The M series has a horizontal field of view of 120°, vertical field of view of 25°, and can detect up to 250 meters, with an impressive near field detection ability. With both horizontal and vertical resolutions averaging 0.2°, the M Series has a unique intelligent "gaze" function that dynamically increases the vertical resolution of the ROI region to 0.1°, or even higher. In addition, the M series has a relatively small size of 108 (L) × 110 (W) × 45 (H) mm.

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

Xie: Conventional sensors have limitations: cameras do not work properly in poor ambient lighting conditions, while millimeter-wave radar has limitations in detecting stationary non-metallic obstacles. They cannot ensure sufficient safety redundancy for autonomous driving perception system. A robust perception system will fuse lidar, millimeter-wave radar, and camera data together for redundancy.

With over 7 years' lidar mass production experience, RoboSense has accumulated a huge number of point cloud test scenarios and developed a point cloud optimization algorithm for extreme weather conditions, to help our customers ensure the performance of lidar under extreme weather conditions.

DVN: What about power?

Xie: The power of a lidar system is composed by multiple modules such as transmitting module; receiving module; scanning module, and digital back-end module. The power of M series, RS-lidar-M1, is 15W.

For transmitting and receiving modules, the power depends on lidar ranging capabilities and resolution requirements. The higher the resolution of the product, the higher the ranging capability, and the higher the power consumption. However, based on specific performance requirements, manufacturers can improve the efficiency of electro-optical conversion and optical transmission efficiency by optimizing circuit and optical design, to reduce the transmission and reception power.

Different lidar scanning architectures also impact the power consumption. The M series products use 2D scanning MEMS galvanometer architecture, equipped with very few transmitters and receivers, which greatly reduces the power of scanning unit. For example, while the M1Plidar has a rated power of 15W, its MEMS galvanometer module only uses 2W.

The power consumption of digital back-end module depends on the computing power requirements. By reducing number of channels and integrating the chip, the power can be greatly reduced. In addition, the power can also be realized by improving power supply efficiency.

DVN: How do you see the applications and market segments regarding lidar range?

Xie: Long-range lidar, take M series as example, its detection range reaches 200 meters @ 10%. Our RS-Ruby plus, as a 128-beam flagship mechanical lidar product, has detection range of 240 meters @ 10%. The market for medium- and long-range lidar is now mature. The lidar industry is now entering into the large-scale mass production stage, and short-range lidar is part of i

E1 blind spot lidar

Short-range lidar has advantages of ultra-large vertical and horizontal field of view, by complementing forward-looking lidar to realize coverage of 360° horizontal field of view. Take our blind spot lidar E1: our customer only needs to add 2 E1s on the basis of M1 to realize the ultimate cost-effective solution of 360° full coverage. M1 not only reduces the hardware cost of lidar solution, but also reduces the communication cost for working with different lidar teams, while also reduces the lidar perception solution cost in R&D design, installation and deployment, and offline calibration.

Short- and long-range lidars can be widely used in autonomous and assisted-driving passenger cars and commercial vehicles; unmanned logistics vehicles; robots; robotaxis; robotrucks and buses, and new infrastructure of intelligent transportation and other sub-fields.

DVN: What's the technical future of lidars? Will FMCW technology come soon?

Xie: At present, many lidar companies adopt ToF as the technical route, which is the mainstream. Mechanical; hybrid solid-state; and solid-state, all of them use the ToF principle for ranging. Although FMCW technology has advantages of long detection distance and direct radial speed, there are still many disadvantages such as big size; high cost, and difficulty in mass production, so it will still be some time before its automotive mass production. In general, RoboSense remains open to all technical routes to quickly respond to customer requirements and market demand.

The main technical challenge of current FMCW solution lies in the integration of silicon photonics chips with lasers and amplifiers, and the industrial chain is still immature; At the same time, ranging ability of TOF solution is getting stronger, accordingly the enthusiasm for FMCW is not so keen, which dampens the promotion of FMCW solution.

DVN: Are lidar and imaging radar competing or complementary? Do you think the radar/lidar performance and cost gaps will narrow?

Xie: Lidar and imaging radar are complementary technologies and have their own advantages in different scenarios and applications. lidar uses laser beams to measure the reflection time and intensity to obtain the three-dimensional spatial information of targets. It is suitable for indoor and outdoor environments and has very high precision and stability. Imaging radar, on the other hand, uses electromagnetic waves reflected from targets to obtain their image information. It is suitable for outdoor environments with low light conditions and can provide a wider field of view and faster data acquisition speed.

The performance and cost gap between radar and lidar is still relatively significant, but this gap is gradually narrowing. The development of new optoelectronic devices and algorithms has made lidar more affordable, while high-resolution imaging radar can improve performance by collecting data in multiple frequency bands and using advanced signal processing techniques.

In summary, lidar and imaging radar are complementary technologies with their own advantages in different application scenarios. As technology advances, the performance and cost gap between them will gradually narrow, making them more suitable for a wider range of applications.

DVN: How do the world's automotive markets differ in terms of lidar market development? Is autonomous driving a key factor for lidar growth?

Xie: Lidar companies have shown a positive trend in terms of R&D, product strength, mass production progress, and design wins. Differences between countries can be viewed from two perspectives:

• The speed from R&D to mass production

Chinese lidar companies have shown particularly strong interest in automotive-grade lidar technology. It can be said that after 2021, the progress of China's top lidar manufacturers' automotive products has basically exceeded that of overseas manufacturers. For example, RoboSense's second-generation smart solid-state lidar achieved mass production and delivery in June 2021, which as the first case globally on two-dimensional MEMS scanning route, while most overseas enterprises' products were in the B-sample stage during the same period. In 2022, China leading automotive-grade lidar companies have entered mass production, while most overseas products still in prototype stage.

• Demand for lidar products from carmakers

Thanks to rapid development of electric vehicle in China market, intelligent driving has gradually become the second battlefield for brand differentiation competition among car manufacturers, and China has quickly become the largest market for lidar, the demand for lidar embraces explosive growth. Due to the advantages in large-scale mass production progress, Chinese lidar companies have won a large number of design wins, for example, RoboSense has obtained design wins from nearly 20 leading carmakers with a total of over 50 models and has built the industry's largest intelligent manufacturing system. We believe, the global market for lidar is large enough, and all the lidar companies will embrace satisfactory future development with the future expansion of market scale.

Lidar development is linked to autonomous driving. As the first large-scale application in automotive, it is necessary to obtain design wins from carmakers to obtain the complete development requirements, so as to carry out complete test verification and automated production line design and operation. It can bring stable funding sources while achieving large-scale mass production and delivery. In addition, after the harsh test of vehicle reliability, the reliability of lidar will jump to a new level.

But this does not mean lidar is only for autonomous driving. We believe robot will bring more lidar application. After mass adoption on vehicles and with the scale effect, lidar cost will get to a much lower level, so various robots will have opportunity to equip with better sensors...that means lidar.

OP-ED

Tesla's Tales vs. Real-World AD Hardware, Software Needs

Op-Ed by Dan O'Dowd, special to DVN

Elon Musk actively promotes his Tesla cars' upgraded level-2 ADAS suite, available for an extra USD $15,000, as "Full Self-Driving", a moniker the world's regulators and watchdogs are increasingly calling wholly inaccurate. Musk also scorns lidar as "a fool's errand" and mocks its proponents—the entire rest of the ADAS · AD · AV world—as "doomed" and "losers". Yet lidarless Teslas are driving themselves and their occupants into harm's way in kinds and severities of crashes not seen in more realistically-equipped and -configured cars. What's going on?

Clearly, Tesla haven't marketed anything like a fully self-driving car. Just as clearly, Musk is eager to offer (or at least be perceived as offering) a 'full self-driving' car. He's been promising full self-driving "next year" for **at least nine years**. He's also keen to achieve this (or be perceived as achieving it) at the lowest possible price; that would explain his singular scorn of lidar, as well as his latest decision to delete the ultrasonic sensors from new Teslas. He's **admitted** that (real) full self-driving is "really the difference between Tesla being worth a lot of money or worth basically zero".

That means he's betting Tesla's fortunes on using questionable software blinkered by inadequate, outdated hardware to solve the huge challenges of autonomous driving. A prime example is the cameras mounted in the B-pillars. Located behind the driver, these are what Tesla's 'Full Self-Driving' software uses to see traffic crossing ahead, so it can make judgement calls during one of the riskiest driving manœuvres: crossing or merging into fast-moving traffic. This is challenging for an experienced human driver, but it is abjectly hazardous for Tesla's 'Full Self-Driving' software, saddled as it is with under-equipped, underspecified hardware.

Imagine this common situation: you come to an intersection with a stop sign and need to get across to continue straight, or you need to turn across traffic into the far lane. The cross traffic has no traffic control, so you'll need to cross and/or join a fast-moving stream of vehicles from a stop. To do this safely requires a vantage point that allows you to see a good distance in both directions, so you can spot and judge the adequacy of a gap that will allow you to cross and/or join the traffic stream.

Often in these situations an obstruction—garbage cans; a bus stop; parked cars, or something else—means you must move forward for a better view, and crane your neck to look left and right. A human driver can easily adjust themselves this way, and so can make an accurate decision on when it is safe to go.

Tesla's B-pillar cameras are mounted between the front and rear doors on each side, about 20 cm further to the rear of the car than the driver's eyes. Musk bragged about the positioning of these cameras at Tesla's Autonomy Investor Day in April 2019: "The cameras in the car have a better vantage point than a person". This is clearly not the case—a human driver can lean forward to reposition their eyes so as to see what must be seen, but Tesla's 'Full Self-Driving' software can't; it's stuck with the physically-hindered viewpoint of the cameras. So it is physically unable to dependably see oncoming traffic, let alone accurately judge its distance or speed. Cars with 'Full Self-Driving', therefore, cannot safely navigate this type of intersection. They're terrible at it, because the software lacks the kind and amount of input needed to determine whether it is safe to go. And that's under the best of conditions; the B-pillar cameras have even bigger **problems** with certain sun angles. It is as if a human driver were tightly duct-taped to their seatback, with their head locked straight forward and the car's left and right windows painted black, and the car's sunvisors removed.

Musk has promised that any Tesla bought after 2016 would be capable of full self-driving without hardware upgrades, but a bit of scrutiny shows this cannot possibly be true. There is very little that could realistically be done to fix the obvious inadequacy and clear safety risk posed by the inadequate, poorly-configured hardware. Tesla would need to either move the existing cameras much further forward or install completely new ones. This would be a huge, costly operation that would require drilling holes in the car and reworking the electronics—likely not feasible.

This is a fundamental and awful error from Tesla, one of **many I've catalogued and analysed**. The B-pillar camera problem should have been obvious to Tesla's engineers from an early stage. Perhaps it was, but the concern was overruled or went unvoiced;

Whatever the reasons why the B-pillar cameras are what and where they are, they're just not adequate to the task. They are an exemplar of numerous other shortcomings; flaws, and failures in Tesla's 'Full Self-Driving' product—hardware and software alike. Everybody whose opinion is relevant agrees that redundant hardware and robustly errorproof software are inescapably necessary for any amount of real, safe self-driving. Musk is the only dissenter; he insists he's right and the whole rest of the world is wrong, but there's a growing pile of crash debris—car parts and people-parts alike—demonstrating he's wrong about that, too.

Dan O'Dowd is the Founder of The Dawn Project, a public safety advocacy group campaigning to make computers safe for humanity. He is a world-renowned expert in creating software that never fails and can't be hacked, and created secure operating systems for projects including Boeing's 787s; Lockheed Martin's F-35 fighter jet; the Boeing B1-B intercontinental nuclear bomber, and NASA's Orion crew exploration vehicle.

O'Dowd is a worldwide authority in embedded safety and security, creating safe and secure real-time operating systems to support a broad range of hardware and software platforms in multiple industries including avionics; self-driving cars, and remotely-controlled medical equipment.

The security of his operating system has met the highest standards of the Federal Aviation Administration, as well as those of the National Security Agency and the National Institute of Standards and Technology—the latter a certification no other company in the world has yet achieved.

*DVN recently **reported** on O'Dowd's Super Bowl advert showing the poor safety performance of Tesla's ADAS suite.*

LIDAR BUSINESS

Lidar Business News

RoboSense announced their nominated supply project with SAIC's Rising Auto brand. Several models, such as the F7 and the IM LS7 are being equipped with RoboSense's M series lidar. RoboSense has helped with the mass production and implementation of SAIC's Xiangdao Robotaxi 2.0 driverless mobility services project. In addition, Shangqi Capital, an investment subsidiary of SAIC Motor, reached a strategic investment agreement with RoboSense.

Innovusion, and Cao Cao Mobility, a ride-hailing platform backed by Geely, have entered into a strategic cooperation. Innovusion's high-performance lidar products entered mass production in 2022, with over 70,000 units delivered annually. The company holds a production capacity of 250,000 lidar units per year.

Ouster has filed a patent-infringement complaint with the U.S. International Trade Commission (ITC) against China's **Hesai Group** and related entities. Ouster also filed a patent-infringement complaint against Hesai in a U.S. District Court. In 2019, Velodyne Lidar brought a patent infringement lawsuit against Hesai; Hesai settled for payment of millions of dollars upfront and ongoing royalties.

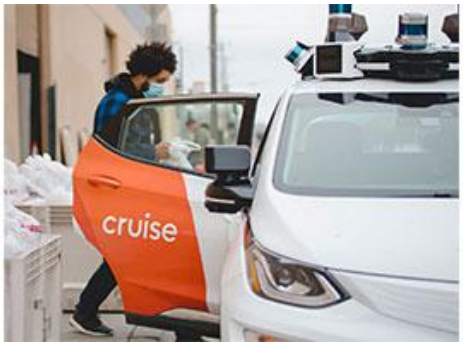
Luminar announced a partnership with **TPK**, a supplier to companies like Apple and Tesla. The partnership aims to build and operate a high-volume factory to meet growing demand in Asia. The company now boasts a global manufacturing footprint that includes the United States; Mexico; Thailand, and China. The new factory will initially be capable of producing up to 600,000 Luminar lidar sensors annually to support awarded programs from automakers, including Mercedes-Benz.

Innovusion's Falcon lidar has won a prestigious Tech.AD Europe Award. Innovusion's Falcon was chosen in the Perception & Sensing category. Falcon lidar can detect objects at distances up to 500 meters, and dark objects with 10% reflectance up to 250 meters. Engineered to be highly resistant to interference by the likes of sunlight, Falcon lidars are standard equipment for Nio's ET7; EL7, and ET5 EVs.

Kodiak Robotics has introduced their fifth-generation autonomous truck hardware platform, with increased sensor redundancy. The company has relocated the front-facing Luminar Iris lidar and wide field-of-view camera in each of the mirror-mounted SensorPods™. The long-range sensor suite includes four ZF Full Range radars; two Hesai 360-degree scanning lidars; two Luminar Iris lidar sensors, and eight cameras. Kodiak has several partnerships including Ikea; Werner; Pilot, and Forward.

Great Wall Motor-backed autonomous driving solution developer **Haomo** released their new DriveGPT, a large model for autonomous driving. By introducing driving data to establish RLHF (reinforcement learning from human feedback) technology, DriveGPT continuously optimizes the cognitive decision-making model of autonomous driving. The first vehicle model using Haomo's HPilot 3.0, the new WeyY Mocca, will soon be available on the market. The company has already signed nomination supply contracts with three major automakers.

Navya announced the decision of the Court of Lyon, to sell its assets for €1.4m to **Gaussin**, through a joint venture with the Japanese group **Macnica**. Gaussin has developed a trailer tractor for logistics warehouses, which they sold to Amazon and UPS. Macnica is developing semiconductors and network-related software and hardware, and has many customers in the automotive field.

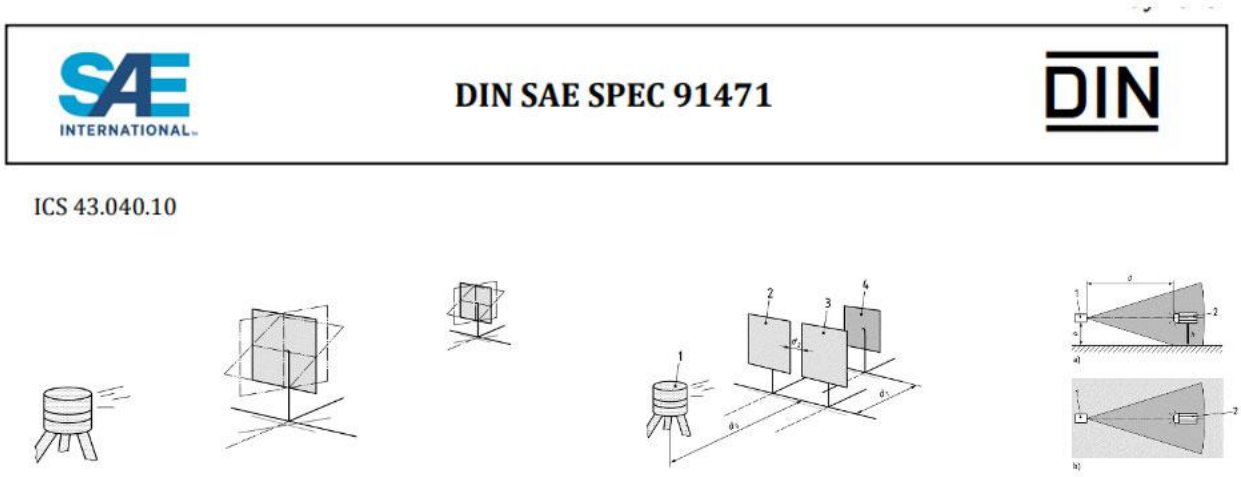


Cruise CEO Kyle Vogt said the company is on track for to reach $1bn in revenue by 2025. Since June, Cruise has a commercial fleet of 150 modified Chevrolet Bolts in San Francisco. The vehicles are said to be designed for robotaxi use, though they **haven't** been **free** of **problems**. Cruise will need 5,500 to 6,000 vehicles operating every day to achieve their $1bn revenue target by 2025, according to calculations by Sam Abuelsamid, a research analyst at Guidehouse Insights. That assumes Cruise is operating in 10 cities with 550 to 600 vehicles in each location, he said, with fares of about $2.50 per mile.

Zeekr Intelligent Technology, the company behind Geely's Zeekr brand, signed a strategic cooperation memorandum of understanding with **Intel** for the development of automotive hardware products, intelligent in-car applications and solutions, as well as the ecosystem construction. Zeekr will collaborate with **Mobileye**, with a goal to deliver the world's first autonomous vehicles with L^4 capabilities by 2024.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

New DIN-SAE Standard for Car Lidar Performance Tests



Up to now, no standard for automotive lidar sensor assessment has existed. Now, a joint SAE-DIN standard, Nº 91471, is the first such standard to be published. It's entitled Assessment Methodology for Automotive Lidar Sensors, and it provides common sensor specification and characterization guidelines and a common and application-relevant evaluation framework. The use cases are related to environmental sensing, not in-cabin sensing. The targets of this document are:

- to have a clear and generally accepted framework for specification and testing of automotive lidar sensors;
- to create an objective understanding of automotive lidar sensors for consumer groups and other stakeholders;
- to build a trusted basis for automakers for creating RFQs and introduction of the right product;
- to make lidar sensor selection and specification simpler and more efficient for automakers;
- to make lidar sensor development; testing, and specification easier for suppliers;
- to make the automotive lidar market more transparent; profitable; safe, and efficient, and
- to make lidar sensors more readily comparable with other technologies.

Like all other SAE and DIN standards, this document by itself carries no legal or regulatory force, and it cannot change any existing regulations. Any potential power in that realm of a standard such as this is as a resource for regulators to draw on when crafting regulations.

DVN comment

this specification is based on point cloud data to assess the detection capabilities of the technology. Its scope does not include perception software (object detection). It is based on seven static tests to measure 12 KPIs, using simple lambertian targets with different reflectivity.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Hesai's Ultra-Thin Lidar Lives Behind the Windshield

Hesai's ET25 is only 25 mm tall, and offers high performance with a view field of 120°H × 25° V and detection range of up to 225 metres as installed behind the windshield. Its in-cabin design prevents dust and rain from obstructing the lidar's field of view and allows for easy cleaning using existing windshield wipers.

With only 12 watts' power consumption, the ET25 can maintain high-performance operation even in hot conditions without overheating.

Hesai have partnered with glass supplier Fuyao to develop near-infrared anti-reflection glass for the ET25.
Its point frequency exceeds 3 million points per second. With a minimum resolution of only 0.05° × 0.05°, it brings ultra-high resolution and long-range 3D perception to the automotive realm.
Hesai's current AT128 product has already found millions of units' worth of favour with 11 automakers and tech companies including Li Auto; Jidu; HiPhi; Lotus; Changan, and SAIC.

DVN comment

Hesai is one of the two leading lidar suppliers in China, alongside Robosense, and the first to launch an ultra-thin lidar in China.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Cepton's Ultra-Slim Lidar for Windshield Integration

Cepton's new Vista-X90 Plus lidar is extremely compact, with minimal height to enable easy lidar integration behind the windshield and in other locations around the vehicle. The company says the new lidar contains their latest innovations in 3D imaging technology, as well as new advances in their proprietary ASIC chipset.

The new lidar's enclosure is 120 mm wide and deep, and just 24 cm high. That means it can be easily embedded into the roof; the headlamps; the fascia, or behind the windshield. Its added real-time software tunable region of interest (ROI) enables the sensor to maintain an optimal balance between performance and power efficiency across different driving scenarios.

The Vista-X90 Plus has a 90° horizontal field of view, a maximum detection range of 200 meters at 10% reflectivity, and an angular resolution of 0.07° within ROI. It is automotive-grade and consumes less than 13 W. Enabled by Cepton's range of automaker-validated lidar building blocks, it is target priced below $500 in automotive volumes.

DVN comment

Cepton was first to propose lidar integration behind the windshield, and they're now working to keep their competitive advantage with ultra-slim designs like this.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Wideye, Innovusion to Co-Develop Windshield-Inbuilt Lidar

Wideye, a corporate scale-up of the AGC glass group that provides glass for optical sensor integration, and Innovusion are partnering to develop a windshield-integrated lidar solution for vehicles.

The concept is to integrate lidar and camera modules seamlessly behind the windshield, a high position that minimizes the impact on vehicle design; provides better protection against environmental factors; reduces the chance of damage, and benefits from the existing windshield wiper and washer systems.

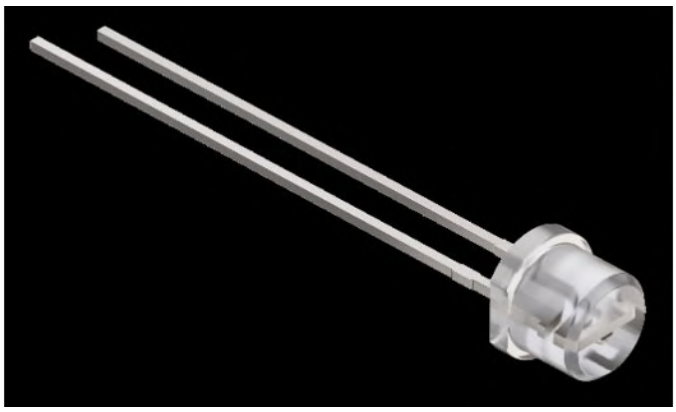
Wideye's high-performance NIR-transparent optical glass offers minimal absorption and maximal transmittance; this enables reliable lidar performance while minimizing the signal-degrading effect of the windshield. Innovusion's Robin-E lidar product is compact at 100 × 117 × 44 mm. It weighs 450 g; consumes 9W, and boasts a noise level less than 20 dB(A).

DVN comment

Wideye was launched by Tokyo-based AGC Group, a leading supplier of flat; automotive, and display glass, chemicals and other high-tech materials and components. Wideye is backed since 2016 by AGC Automotive Europe, who specialize in the production of glazing solutions for carmakers.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

New Osram Laser Diode for Consumer, Industry Applications



AMS Osram has added a higher-performance infrared laser targeting cost-conscious consumer and other applications with their new 75-watt edge-emitting laser in a radial plastic package. The SPL PL90AT03's high peak output power and narrow output aperture result in superior performance in long-distance ranging applications, as well as easier optical integration. Specifically, it features a peak wavelength of 905 nm and a spectral bandwidth (FWHM) of 5 nm. Beam divergence is just 12° (parallel) × 25° (perpendicular), enabling efficient beam shaping with its small 110-µm aperture.
The new diode's low-cost plastic package is ideal for use in high-volume applications. Featuring the same footprint as the previous generation of SPL PL90 series laser diodes, the new SPL PL90AT03 provides an easy upgrade to higher efficiency, thanks to its state-of-the-art chip technology. It produces a narrower emission width and enables easier optical design because of the device's 50-per-cent smaller aperture versus its predecessor.

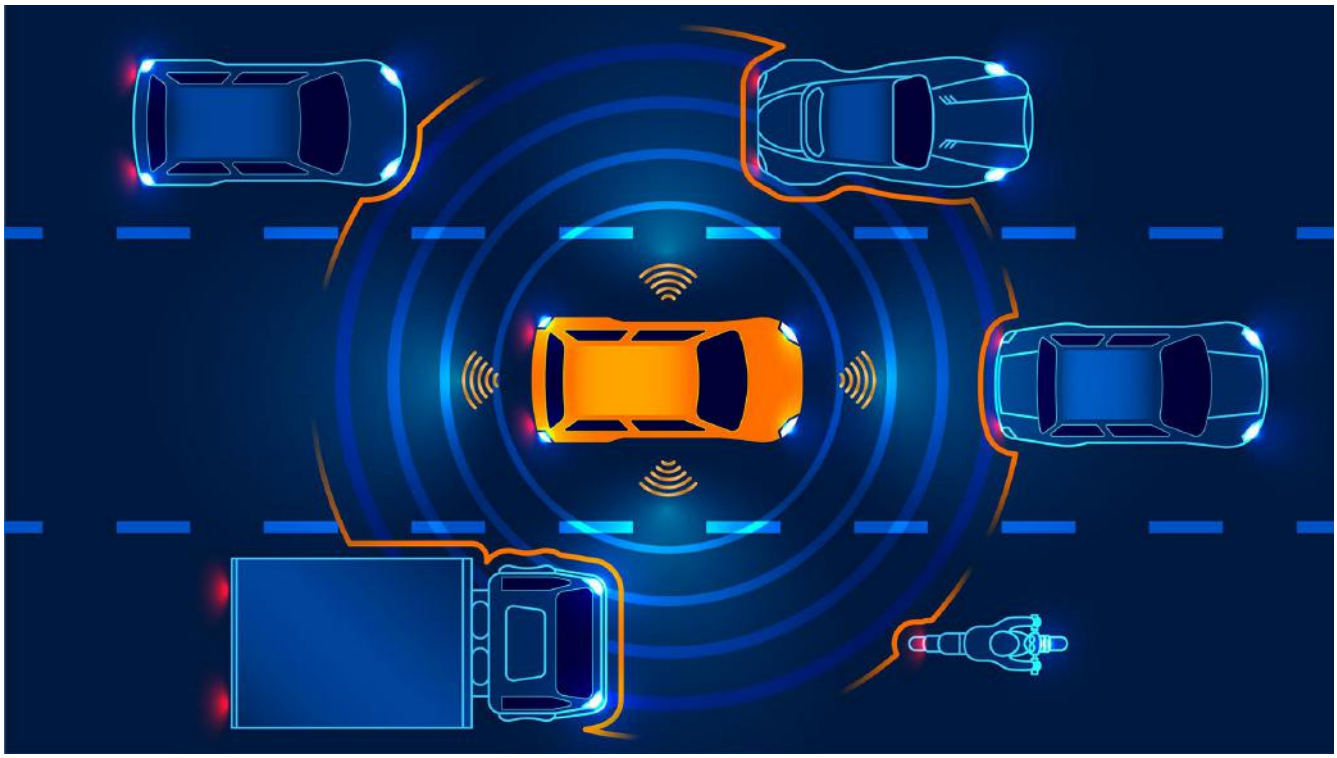
The single-channel diode features multi-junction technology comprising three vertically-stacked emitters in a single laser die mounted inside the radial plastic package. This technology enables the laser to produce 75-watt optical peak output power in a 30-ns pulse at the device's maximum forward current of 25 A. The laser diode can produce short laser pulses ranging from a few to 100 ns.
The high optical power output in a narrow emission area makes the new laser diode well suited for ranging and distance-measurement applications that operate over long distance, such as robots; drones, and home- and factory-automation equipment. In time-of-flight sensing and lidar applications, the diode's high performance enables the production of more precise and accurate depth maps for 3D optical sensing and simultaneous localization and mapping (SLAM) systems.

DVN comment

Osram Opto Semiconductors offers the strongest lidar portfolio on the market with VCSELs and EELs. The variety of EEL package designs—TO, plastic, SMT—allows application flexibility and serves a great spectrum of different power classes.

AUTOMATED DRIVING

Automated Driving is Coming, All Over the World!



USA: Cruise says they have made significant progress in handling bad weather. The've deployed custom sensor-cleaning solutions to keep lenses clear of water and dirt, and say their AI system has 'learned' to detect and filter out "phantom objects" that might otherwise lead to false positives. Cruise AVs adjust their acceleration; deceleration, and steering behaviors in bad weather conditions, in an effort to mimic a human driver. Cruise says their fleet has maintained 86-per-cent uptime during California's historic winter storms.

China: Pony launched their latest robotaxi model for public-roads testing in the Beijing High-level Automated Driving Demonstration Area (BJHAD). This new system includes four solid-state lidars; three supplemental lidars; three radars, and eleven cameras. The design is lighter of weight and aesthetically pleasing. In addition, the vehicles' performance has been greatly improved in rain; snow; fog, and sandstorms, thanks to the company's self-developed sensor cleaning system.

China: Baidu was granted Shanghai's first batch of fully-unmanned intelligent connected vehicle innovation application testing notices, and will officially kick off autonomous road test in the city without safety operators onboard. Baidu Apollo's L^4 autonomous-driving tests have accumulated 50 million kilometers so far.

China: TuSimple has become one of the first companies to receive a testing permit for the innovative application of driverless intelligent connected vehicles in Shanghai. TuSimple has been conducting routine testing on the Yangshan Port Phase IV Terminal-Donghai Bridge-Shenshui Port Logistics Park route for container transportation. The company has developed key technologies such as automatic container loading and unloading; task information exchange systems, and automatic gate passage in the port area.

China: Didi'srobotaxis became available on 27 March for ride-hailing in Guangzhou City, Guangdong Province. They're customized Volvo XC90s on DiDi's proprietary TwinStar autonomous driving platform.

Beijing - Haomo.ai, the autonomous driving solution developer backed by Great Wall Motor, saw its terminal delivery vehicles licensed by the Beijing High-level Automated Driving Demonstration Area (BJHAD). The vehicle, named Xiaomotuo 2.0 in Chinese (128,800 yen per unit), is Haomo.ai's proprietary self-driving vehicle targeting the last-mile terminal goods delivery scenario. The licenses give the vehicles permission to conduct normalized tests and operations.

China: Neolix, a Chinese developer of self-driving vehicles, has completed evaluations and audits to become the first licensed low-speed autonomous vehicle enterprise in Hainan Province. Neolix is currently working with SF Express and China Post to develop city-level low-speed autonomous vehicle deployment projects in Haikou and Qionghai cities in Hainan. The company aims to deploy more than 1,000 low-speed autonomous vehicles.

Japan: Suzuki has signed a memorandum of understanding with the Australian technology company Applied Electric Vehicles for the co-development of an autonomous EV platform. Applied EV specializes in software development and supply in the mobility field. In this collaboration, Applied EV's autonomous vehicle platform, Blanc Robot™, will be integrated into Suzuki's 4WD Jimny, electrified by Applied EV, and controlled by their central control system, Digital Backbone™.

UK: Oxbotica, an AV software developer, has partnered with Google Cloud to accelerate the deployment of their software platform and their AD solutions for businesses such as last-mile logistics; agriculture; light industry, and public transport. Oxbotica will accelerate the development and validation of their self-driving technology by using Google Cloud products like Vertex AI; compute; storage; and networking. Google Cloud will provide the data and machine learning tools to enable MetaDriver to apply Oxbotica's generative AI tools to an extensive bank of virtual scenarios.

DVN-LIDAR DEEP DIVE

DVN-L Deep Dive II: 5 and 6 June 2023

The second DVN-Lidar Deep Dive Workshop of 2023 will take place this coming 5-6 June at the hotel Dorint Pallas in Wiesbaden, Germany. Here's an update on the developing docket:

5 June

18:30 Welcome of live participants
19:00 Cocktail
20:00 Dinner

6 June

8:30 Opening and introduction of participants

Session 1: Lidar Applications, Short- and Long-Range
9:00 Lidar applications for the European and US markets (Torc Robotics for DAI-Trucks)
9:20 Lidar applications for the Chinese market (LS-Lidar)

Session 2: Focus on Short-Range Lidars
9:40 Lidar sensors - short range (Continental)
10:00 Lidar sensors - short range (Cepton-tbc)
10:20 Conclusion: Four questions to the community

10:25 Coffee break

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

12:35 Lunch break

Session 3: Innovations in Optics
13:50 Innovations & micro lens optics (Süss Optics)
14:10 Innovations & standard optics (Doctor Optics)
14:30 Conclusion: Two questions to the community

14:35 Four 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