DVN
Lidar

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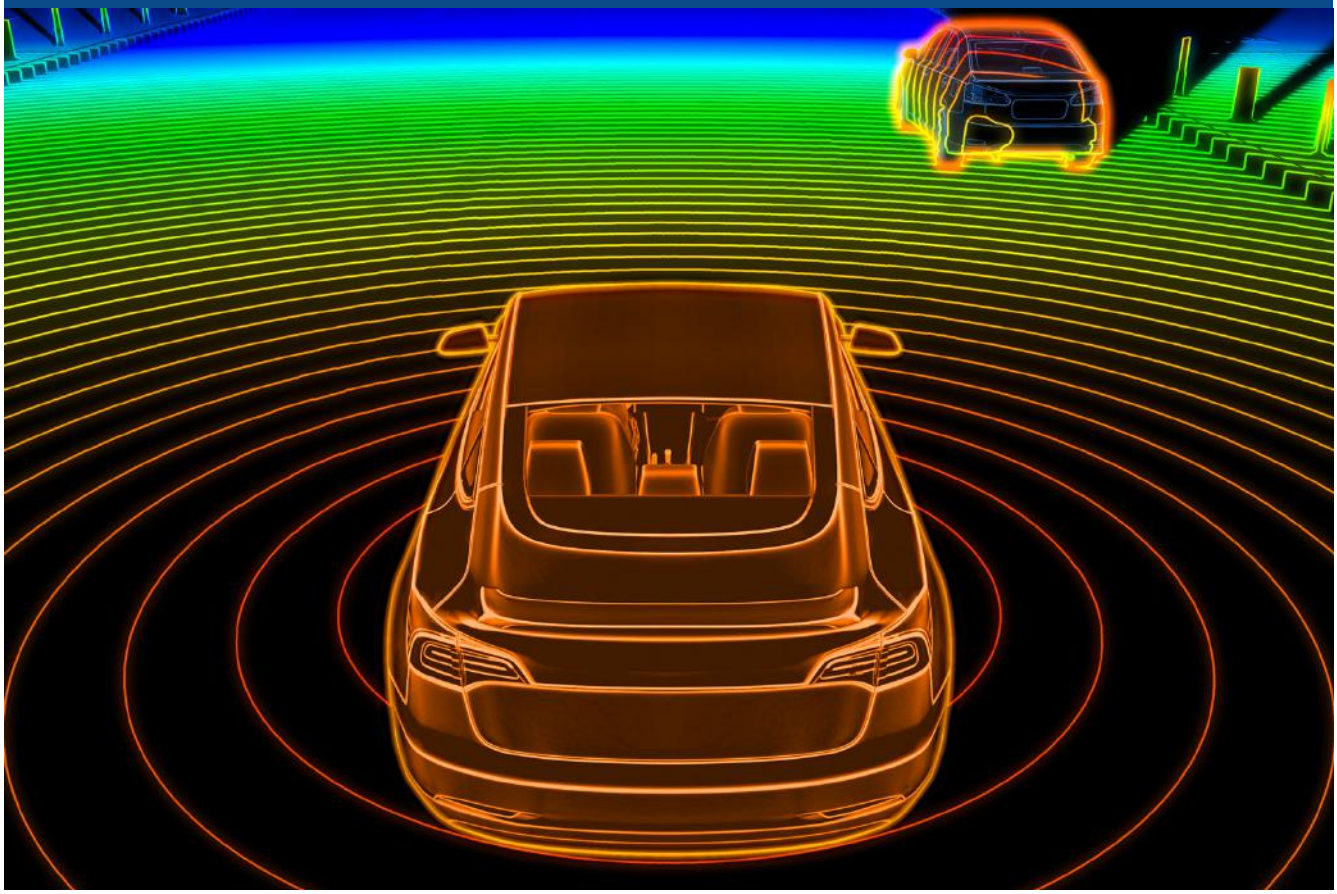


EDITORIAL

Winners Use Lidar After All!

Everyone whose opinion counts on the matter knows lidar is central; crucial; indispensable, and utterly necessary for an effective, safe, *real* autonomous vehicle. Tesla CEO Elon Musk disagrees; he says lidar is for losers, even as he's been unable to deliver any actual self-driving and his cars have an alarming track record of behaving badly in traffic. Now Tesla's dream is coming true—for Xpeng, whose G9 is entering mass production.

The G9 has two RoboSense front lidars and can be configured as a robotaxi with just software-only changes.

That sounds more like winning to us.

All over the automotive sector, lidar is going from strength to strength. Major Chinese lidar supplier Hesai is now profitable, and they're becoming a global supplier—they're opening a European R&D center in Stuttgart, Germany.

And lidar integration is evolving at a quick pace, too, with behind-the-windshield placement increasingly popular; see our interview with Wideye's Raed El-Makhour in this edition of your DVN-L Newsletter.

Also in this edition, we've hurried to bring you the first report of our Lidar Deep Dive II, held 6 June in Wiesbaden, with a focus on short-range lidar requirements and optical innovations.

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

- DVN-L Deep Dive III (USA): 29-30 August in the San Francisco Bay area
- DVN-L Conference (Europe): 29-30 November in Wiesbaden, Germany

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

All best,

Alain Servel

DVN LIDAR SENIOR ADVISOR

DVN-LIDAR DEEP DIVE

DVN-Lidar Deep Dive II First Report

The DVN-Lidar Deep Dive II, held at Wiesbaden on 6 June, focused on short- and long-range lidar requirements, and innovations in optics.

With 40 participants registered, we had a large group of experts from automakers; lidar tier-1s; electronics makers, and optics specialists. All had the opportunity to discuss technical issues in small working groups, then share with the larger group.

There were six speakers, representing automakers and tier-1 and -2 suppliers—including a Chinese speaker. Here we bring you a summary of the presentations:

Torc Robotics: Application of Lidar for L^4 Automated Trucks
Sebastian Renken · lidar sensor development engineer

• Motivation (including driver shortage) and business case for driveless trucks
• Hub-to-hub driverless long-haul operation (US highways)
• Sensor suite includes ultralong- (300m); long-, and short-range (40m) lidars
• Lifetime targets: 3-4 years of operation; >25,000 hours; >1.4 million km
• ODD definition: scenarios; critical use cases, recordings from the field
• "A lost-cargo event happens on average 2 times in the lifetime of a truck".

LS Lidar: An Overview of Lidar Applications
Millie Yang · overseas market director

• Development status of lidar and scanning technologies: mechanical; MEMS; hybrid solid-state; optical phased array...
• LS Lidar products for shuttles; robotaxis, coöperative ITS applications
• Performance of 1,550-nm lidars: high resolution and point density
• Light sources, such as fiber lasers, are 80 to 85 per cent of the cost
• System-on-chip solution lowers cost
• "Lidar is the eye of autonomous systems; hybrid solid-state is still the mainstream"

Continental: Short Range Lidar—A Field of View Analysis for SAE Level 4
Robert Klarer · lidar perception release train engineer

• Parking: curb along the car; parking manœuvre in narrow space, VRUs nearby
• Design compromsie: rate/resolution/range and photon power budget
• Specs: 40m @ 0.3-0.45° resolution; ambitious 140-180°H ×100°V FoV
• Frame rate: 20Hz minimum to detect pedestrian crossing street at the last minute
• "The market price for a short-range lidar is around €100 - €200".

Continental: Short Range Lidar—A Field of View Analysis for SAE Level 4
Wolfgang Schulz · lidar perception product owner

• Short-range applications for trucks (long haul operation) & robotaxis (urban traffic)
• Trucks: how to manage the manœuvre inside the hub and when exiting the hub
• Critical use cases: minimum-risk manœuvre; traffic jam when entering the hub
• Automated parking applications: parking in/out; mapping of stalls/slots, ramps
• Possible sensor suite integration for cars; robotaxis, trucks
• "The truck business is expected to be the first real application of short-range lidar; it will come soon".

Cepton: Introduction to Short-Range Lidars
Henri Häfner · director of product management; marketing, and business development

• Typical specifications for short- (40m); mid-, long-range (200m+)
• High resolution and large FoV_V to detect objects on road and overhanging load
• Specs: 120° × 90° FoV and min range detection < 0.1m
• Proprietary SoC (Kommodo) to reduce costs & packaging size
• "Lidar is the only technology to combine high resolution of 0.3° and large FoV_V, and which can support object classification like the camera".

Docter Optics: Precision-Moulded Lidar Optics in Volume
Hagen Schweitzer · head of optical design development

• Design process including importance of thermal simulation and optimization
• Cost reduction; aspherical lenses reduce lens count
• Isotherm glass moulding for high precision; non-isotherm for low cost
• Combination of cheaper non-isotherm moulding with DOCµTEC (×10 precision)
• Miniaturization: integrating the receiver inside the lens
• "Optics must deal with a 50-mm maximum lidar aperture height".

Suss MicroOptics: Miniaturizing Lidar Systems with Microöptics
Wilfried Noell · senior principal scientist

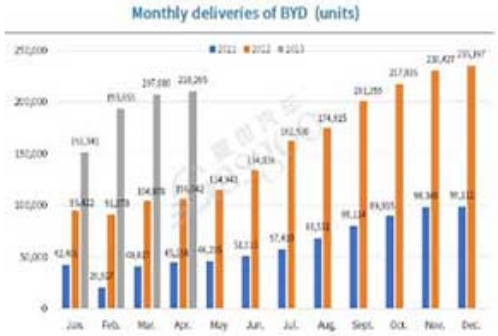
• Ultra-compact microprojector (BMW's door-side light carpet)
• Microlens arrays in headlamps
• Silicon photonic applications with microlenses (in production for data centers)
• Microöptical applications for beam shaping; collimation and SPAD receiver
• Wafer-level microöptics with lenslets up to ø1mm
• Collimating lenses of silicon and glass
• Integrated microlenses for prism
• "There is a big opportunity for microöptics in lidar applications".

Strong consensus emerged during the Deep Dive regarding short-range lidar applications:

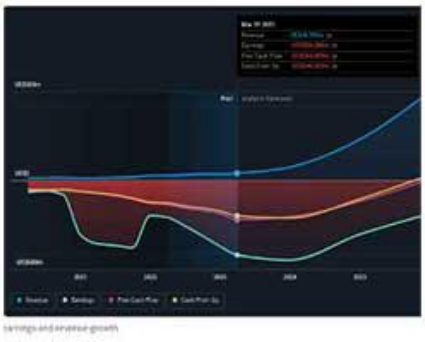
• Short-range lidar requirements are converging toward a 40m range and a 0.2°-0.3° resolution for trucks; robotaxis, and passenger cars (auto-valet parking)
• Driverless trucks: 25,000-hour lifetime can be achieved with VCSEL technology
• Automated parking: there is no alternative to short-range lidar to cover all critical use cases
• Optical design offers new opportunities to optimize packaging and costs • Market price around €100 - €200 is the target; €100 might still be too expensive for auto-valet parking

LIDAR BUSINESS

Lidar Business News Bites



BYD sold 210,295 vehicles in April—98.31 per cent more than the previous year. April sales of battery electric vehicles (BEVs) reached 104,364 units, while 105,103 plug-in electric vehicles (PHEV) were sold in the same period. The company wants to sell three million vehicles through 2023, implying an average of 280,000 vehicles per month for the rest of the year.



Luminar reported Q1 earnings with revenues at $14.5m, and a GAAP loss of $146m. The partner facility with Celestica in Mexico, with a capacity of 60,000 units per year, is in validation testing, and the TPK partnership in Asia will add capacity to support customers on that continent. Luminar tech is designed into more than 20 production vehicles slated for the Chinese market. Mercedes-Benz announced their plans for the Iris+ sensor across a broad range of their next generation vehicles by mid-decade.

Hesai announced a revenue of **$62.6m in Q1-2023,** and agross margin of 37.8 per cent. They shipped 34,834 lidar units, of which 28,195 were ADAS lidars. **Hesai achieved positive Non-GAAP net income and operating cash flow.** This quarter, Hesai has won new ADAS contracts, including new models from **Li Auto**'s pure battery electric vehicle (BEV) platform; new models from **Jidu**, and various models from **Seres**. Hesai shipments are expected to be 40 per cent higher in Q2-2023.

Mobileye has achieved a 16-per-cent revenue growth in Q1 2023, and an operating cash flow of $171m, highlighting the continuous traction of the firm’s advanced product portfolio, with **multiple SuperVision and Chauffeur programs nearing design win**. The Q4-2023 launch of the Polestar 4—a SuperVision project—is expected to boost customer and regional diversification. Despite the reduction in 2023 SuperVision shipment forecast due to decreasing EV demand in China, Mobileye remains confident about the opportunities to accelerate growth.

Porsche has partnered with **Mobileye**, to bring hands-free automated assistance and navigation functions to future sports cars, based on Mobileye’s SuperVision technology platform. It allows drivers to take their hands off the steering wheel on certain types of roads, as long as they remain visually alert to take control of the vehicle as needed. Porsche says "Intelligent systems like Mobileye SuperVision technology can aid the driver in everyday situations, for example by not having to keep their hands on the wheel the entire time in traffic jams".

Hesai has entered into a strategic partnership with autonomous truck company **KargoBot** to jointly promote the application of Hesai's hybrid solid-state AT128 lidar for L^4 autonomous trucks. The collaboration aims to create more intelligent commercial logistics applications. KargoBot has integrated five AT128 sensors into an autonomous truck, achieving 360-degree FOV coverage and significantly reducing blind spots.

Hesai officially inaugurated their European office in Stuttgart, Germany on 11 May. This incursion is aimed at expanding Hesai's presence in the European market and accelerating their global strategic layout.

AEye's ultra-long range Automated Incident Detection (AID) solution has won a Best of ITS award at ITS America. AEye partnered with MnROAD; the Minnesota Department of Transportation, and VSI Labs to test their 4Sight M lidar sensors on Interstate 94. While MnDOT currently uses cameras to obtain analytics on the flow of traffic on this corridor, the 4Sight M lidar sensor offers more precise tracking of speeds; lane positioning; number of axles, and load profiles. In addition, AEye's AID can detect incidents up to a kilometer away.

Nuro plans additional layoffs, after last November's round of letting go about 300 employees—20 per cent of their staff. Nuro said it would pause commercial deployments and delay production of their third-generation delivery vehicle, the R3. They will also scale back their delivery pilots, which include partnerships with Domino's Pizza and 7-Eleven. The company said "Commercial deployments come at a significant cost; it is prudent to focus on what we can do efficiently as a startup". Founded in 2016, Nuro is one of the few companies operating fully driverless vehicles.

Aurora Innovation aim to commercialize self-driving trucks by next year. Over the past year, they've launched or expanded pilot programs with FedEx; Ryder; Schneider, and Uber Freight. More recently, Aurora announced their self-driving system is “feature complete”, and they deployed the first of their “commercial-ready” autonomous shipping terminals in Palmer, Texas. The company has more than 30 trucks on the road in Texas today, hauling goods with more than 50 trips a week. To date, the trucks have travelled more than 600,000 km.

Continental and **Aurora Innovation** are teaming up to deliver the first commercially-scalable generation of Aurora’s proprietary integrated hardware and software system, the Aurora Driver, targeting the trucking industry. The partnership will see Continental and Aurora jointly design, develop, validate, deliver, and service the system, set to be available to carriers and commercial fleet operators across the U.S. The first production start is slated for 2027.

Bosch is joining forces with autonomous-trucking developer **Plus**, to commercialize software-defined trucks. Under a new technological agreement, Plus' PlusDrive solution will be combined with Bosch's steering system to introduce driver assistance and partially-automated features to commercial vehicles.

INTERVIEW

DVN-L Interview: Wideye's Raed El-Makhour

Raed El Makhour joined **Wideye** by way of AGC in 2021, and is currently the company's Chief Product & Marketing Officer—a leadership role wherein he is responsible for product strategy and roadmap; he also handles market intelligence activity.

From 2016 to 2021, he was with Renesas Electronics, where he served as ADAS segment leader and platform architect responsible for defining ADAS microcontrollers and systems-on-chip for cameras; radars, and lidars. From 2010 to 2016, he worked in R&D at Renault-Nissan, focusing on antenna integration; he then moved to ADAS project management for the Espace; Scenic; Talisman; Kadjar, and Megane models. From 2006 to 2010, he worked as a research engineer at Valeo Electronics and Connective Systems.

He holds an electronics and communications systems engineering degree, and a PhD in electronics from INSA Rennes (National Institute of Applied Science at Rennes, France), sponsored by Valeo.

DVN: What were AGC's objectives when Wideye was created in 2016?

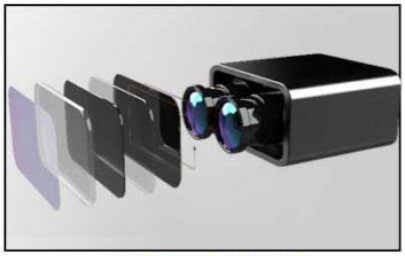
Raed El-Makhour: Wideye is part of the Mobility Business Development Office (formerly Incubation Factory), where AGC gives the opportunity to its employees to innovate while giving them an adequate infrastructure to develop a new business. It's a new way of conceiving and developing innovation. The goal is to address an idea with market demand before starting its development. For Wideye, the idea was to target the autonomous-driving sector, part of AGC strategic focus on CASE (Connected, Autonomous, Shared, Electric) megatrends. Suitability of this ambitious idea, which becomes a global project, is controlled; verified, and sponsored in an iterative process, in a fast and agile manner.

DVN: How do you develop as a startup within a large glass group like AGC?

R.E-M.: Wideye was incubated within AGC in 2016, hence it inherits from all existing AGC processes, but also benefits from flexibility to act as startup, then scale up with our own business plan. Luckily AGC paved the way by providing us the necessary weapons such as financing; resources, and industrial assets. If you add to that a highly motivated and skilled team; an empowerment; a trust relationship, and synergy with top management in Europe and Japan, you could only obtain a success story.

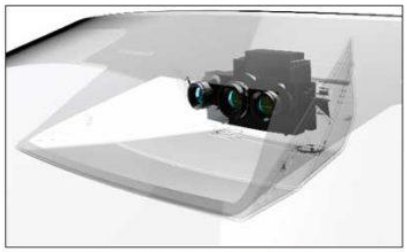
DVN: What can you tell us about Wideye's offerings?

R.E-M.: Wideye offers sensor integration solutions thanks to unique glass composition. Our portfolio includes three product lines targeting camera and lidar integration based on three strategic pillars: performance; reliability, and seamless integration. Some examples:



OPTICAL COVER

GLASS TRIM



VISION GLAZING

- **Optical Sensor Cover**: one of the first components of our portfolio, consisting of an optical sensor cover that goes directly onto the lidar housing. It's an automotive-grade cover with high infrared transmission and functional features such as defrosting mechanisms; anti-reflective coating; water repellent coating, and blackening. Needless to mention, resistance to stone chip impact.
- **Glass Trim**:an optical cover with seamless integration used as a 2D or 3D curved additional protective skin on the car body in different locations such as roof; fender; grille, or B-pillar.
- **Vision Glazing**:one of AGC's core products such as windshield; backlight; or sidelights, aiming to have an optimum use of the exterior glass surface for seamless sensor integration.

On top of the above, Wideye developed an end-to-end design service to support tier-1s and automakers in their journey of sensor integration.

DVN: How do you feel about lidar integration behind the windshield?

R.E-M.: We clearly see a move from bumper to a higher position allowing less exposure to impact and dirt, and a high vantage point optimizing detection. Next to the roof integration for which we have an upcoming SOP at a major automaker with our trim solution, we clearly see a parallel path based on windshield integration

Windshield integration has benefits such as high perspective view; optimal sensor protection by the windshield with lower exposure to dirt and damage, and existing cleaning and defrosting solution. In addition, it allows a seamless sensor integration while respecting vehicle styling and allowing better aerodynamics with a lower drag coefficient.

While windshield inclination angle may cause a signal degradation; our windshield is optimized for the highest infrared transmission; the question is: where should the automaker put the threshold of acceptance while considering a compromise between performance and design?

DVN: Is this solution already mature; will behind-windshield lidar integration become standard? How does wavelength selection factor in?

R.E-M.: Our windshield solution inherits AGC expertise in developing automotive glass. Our Wideye windshield, dedicated for lidar and camera applications, offers high optical quality and compatibility with both 905- and 1550-nm wavelengths. It's today in B-sample phase for a committed business, with a major automaker targeting SOP in mid-2024. In parallel, we have ongoing pre-development programs with automakers exploring this integration and eager to adopt it post development. Will it become a standard? I can say that it will surely play a major role in the integration schemes surviving in the future. One of the main questions is, how to co-integrate multiple cameras; rain sensors; antennas; lidar, and mirror in a small form factor within the vehicle, while preserving the performance. It's a use case Wideye already showcased and for which we are working closely with our customers to achieve at mass production level.

Integration of a lidar and cameras module behind the windshield

DVN: What about cost? Can it be driven down by windshield standardization, or how much hardware diversity is required?

R.E-M.: It will depend on the sensor configuration for each car. If there are only cameras, you'll need a standard windshield; if there is a lidar with the cameras you would need Wideye glass. Both windshields can be produced on the same line at AGC, lowering efforts and cost.

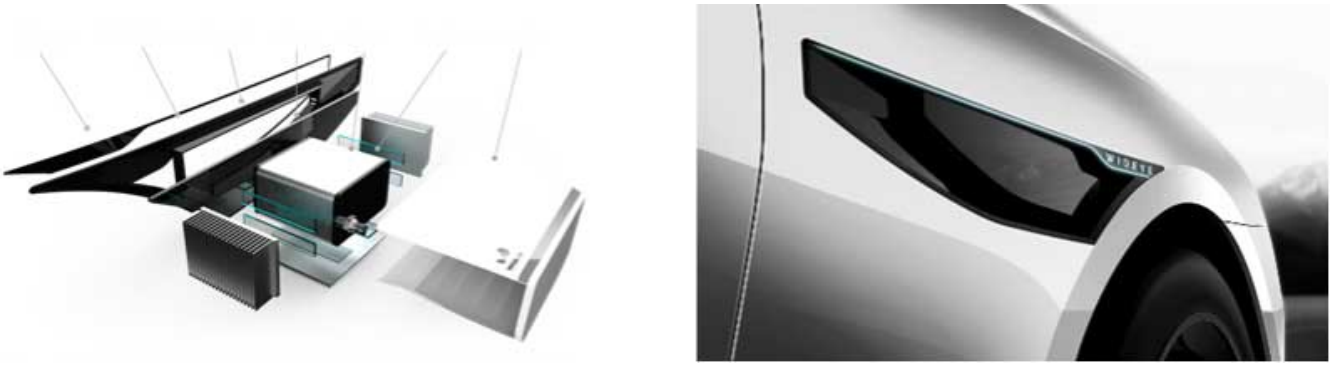
DVN: Wideye recently announced a partnership with Innovusion for windshield integration; what other partnerships do you have (or are you working toward)?

R.E-M.: Wideye's solution is sensor-agnostic and designed to be compatible with all lidar technologies; it covers all integration schemes. We are proud to have established a name within the sensor ecosystem, where we are well connected to major lidar suppliers and automakers globally. Clearly, sensor integration is not plug-and-play anymore, and collaboration with sensor suppliers is key; it even requires a three-party setup with the end customer which is the case for the programs we are nominated on. Since 2016, we've showcased integrations with multiple players like Velodyne; Ouster; Cepton; Xenomatix, and Sony. We have a good partnership with Innovusion—who already proved their solution on the market—and we are also collaborating with Opsys and Luminar (as seen at CES this year). Other pre-developments are in the pipeline, but they're not public yet.

DVN: Yes, at CES Wideye promoted unique 360° integration solutions. Could you tell us more about your concept? Do you have specific solutions for lidar integration in the B-pillar or fender? Is there a cleaning issue similar to the front lidar?

R.E-M.: We showcased a 360° solution with lidar integration in roof; fender; B-pillar; windshield, and bumper, where both B-pillars and windshield lidars were active. Part of our mission is to enable seamless sensor integration all around the vehicle, hence our focus on side integration where we are starting to see some customer requests. Requirement are not as stringent as for front-facing lidar—lower range requirement, less stone impact—but still, our glass makes the difference against plastic, and heating; defrosting, and cleaning are also necessary.

Lidar integration behind B-pillar for parking assistance and 3D-map around the vehicle



Side lidar integration: a sensor mounted seamlessly and aesthetically on the fender

DVN: What do you predict in terms of automotive lidar deployment in the coming years?

R.E-M.: We clearly see that RFQ volumes are boosted compared to three years ago, and lidar deployment is becoming mainstream with a clear move of integration from bumper to roof as first step and windshield as a second.

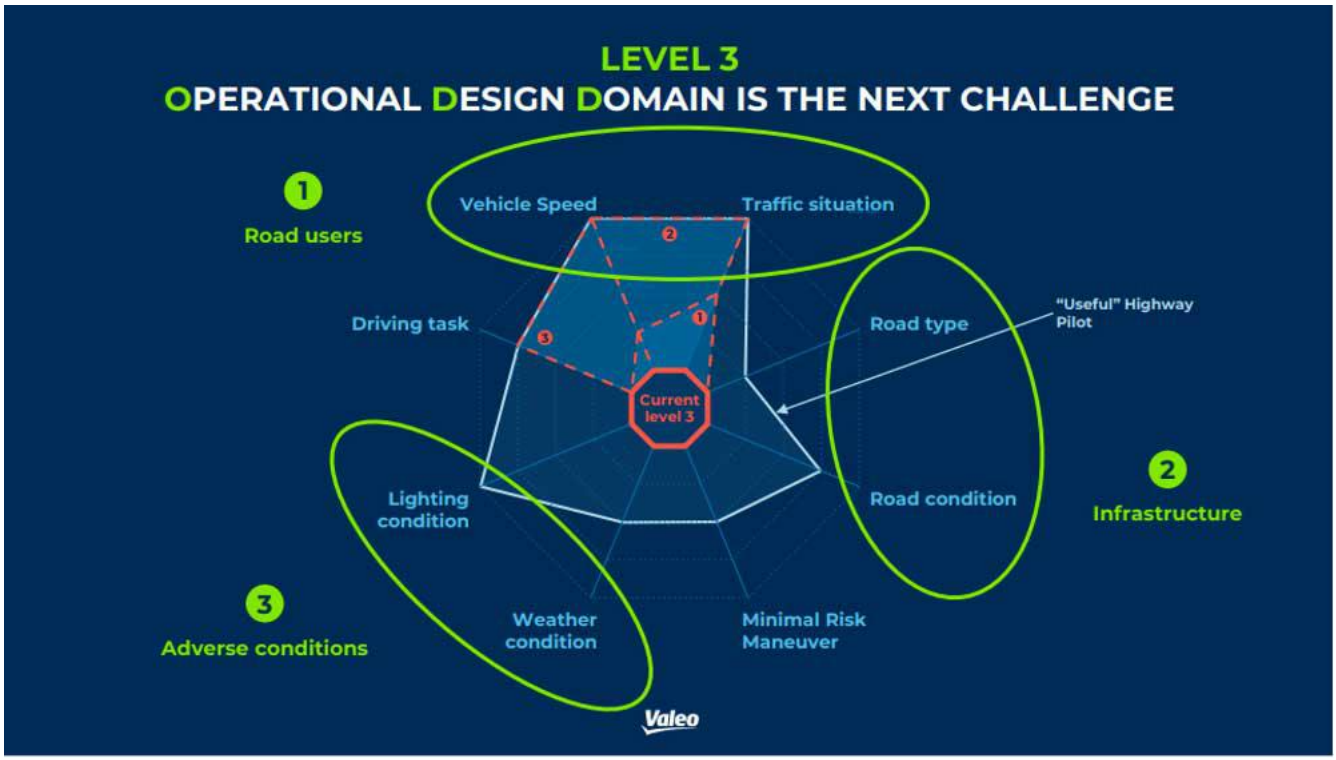
DVN: What are Wideye's ambitions?

R.E-M.: Wideye's solution is targeting automotive applications such as ADAS and autonomous driving. We also have a dedicated solution for industrial markets, under the Wideye Rhino brand. This solution is based on Wideye glass and tuned for industries such as trucks; freight transport; farming, and mining.

With our efficient development process; extensive patent portfolio, and strong business relationships, we are well equipped to play a big role in the ADAS market. In fact, we are already there. Our ambition is to build on our success; deliver our committed SOP programs, and increase our market share. In addition, we plan to expand our business globally—profiting from AGC's footprint in Asia and the US, and we aim to adopt a closer approach to customers by offering turnkey solutions aiming to accelerate time to market.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Special Report: AutoSens 2023



The AutoSens event, held in Detroit on 9 to 11 May, was a good occasion to get an update regarding the limitations of the different sensing technologies to expand the ODD—the operational design domain—which is the next challenge to support a large deployment of AVs.

RGB Cameras: **Nodar** did a presentation on their technology's ability to significantly enhance RGB cameras' performance in nighttime conditions. **Ubicept**, too, explained their real-time fast motion optical imagery across challenging environments.

IR cameras: There was broad consensus at the event taht IR will dratatically improve pedestrian detection, and that at scale, a ~$100 thermal camera will be a reality. However, regulation demanding pedestrian-AEB in bad conditions would be necessary, since buyers won't pay for safety of those outside their own vehicle. It was noted that huge volumes of smartphone sales have driven down the cost of RGB camera technology, but there is no equivalent in sight for IR.

Lidar: the expansion of ODD is a clear driver of lidar penetration. **Aeva** laid out the many benefits of FMCW lidar, which clearly has future. **Valeo** spoke of the 12.3 megapoints-per-second performance of their Scala^3 lidar in two versions: Smart Bumper, and Satellite Slim. **Cepton** showed their lidar's small height and volume—0.63 litre—which allows packaging behind the windshield and an easy cleaning with the wipers.

***Radar*: Arbe** described the many benefits of 4D imaging radar, a technology working in all weather and light conditions. Due to its large number of channels—2,304 of them—imaging radar allows high 3D separation capabilities and tracking, while providing clustering and boundary boxes like a camera.

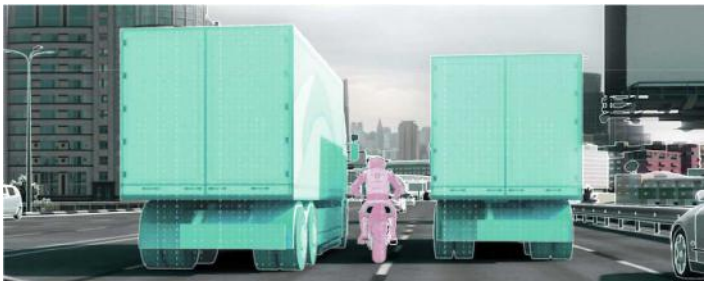
***Lidar Market*: Woodside Capital Partners** shared their view of apposite M&A and investment activity: the depressed market conditions are expected to continue at least through the end of 2023. The SPAC lidar rush of 2021 is well past, and consolidation is taking place. 2023 is expected to be a breakthrough year for lidar design wins, as applications proceed for future production vehicles.

Market trends

- Safety regulations will drive ADAS adoption with L^2 vehicles to almost 50 per cent in 2022;
- Low M&A levels are expected at least through the end of 2023;
- Sensor fusion continues to be a major objective while 2D and 3D cameras with 4D radar will dominate the market in the short term;
- L^3 vehicles will not be produced in significant numbers until 2030, and
- Automotive software will be the dominant focus over the next five to 10 years.

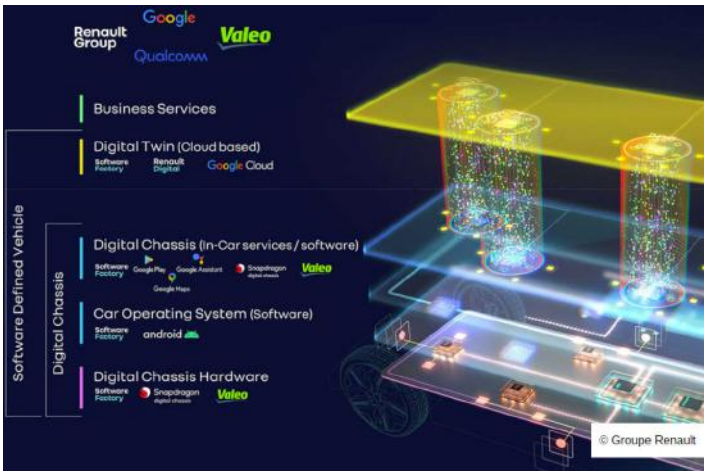
DVN comment

Fusion of 4D imaging radars and 2/3D cameras: the recent partnership between Uhnder (imaging radar technologies), and South Korean Bitsensing (radar solution provider) to develop 4D digital imaging radar solutions for Korean automakers, shows the technology is maturing.



The solution will enable advanced safety features, such as automatic emergency braking (up to 300-metre range for pedestrian detection); adaptive cruise control; and lane departure warning, while also enhancing object detection and tracking capabilities even in heavy rain; snow; fog, and bright sun. In addition, it can provide the best low-level fusion between radar and camera, which enhances the reliability of its performance across various conditions.

Software defined vehicles: a recent partnership announced between Valeo and Renault provides an example of software structure for digital chassis and powertrain management.



LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

ZKW and Rehau Automotive enter cooperation to develop intelligent vehicle fronts

Vehicle lighting system specialists ZKW and plastics specialists Rehau Automotive have decided to jointly drive forward the integration of modern lighting systems in vehicle fronts. The two companies will work together on concepts and pre-development projects to offer customers future-oriented solutions for the connection of light; sensor technology, and electronics in the vehicle front end.

The goal of the cooperation is to offer significant added value for customers from the automotive industry through bundled competences. They're working on a 'seamless intelligent vehicle front' concept which can be integrated as a complete system; the front-end concept has lights; logos; sensors, and heating elements.

ZKW and Rehau already are working together on various concepts for car manufacturers. The development of an integrated vehicle front as part of the joint cooperation was launched in April.

DVN comment

Headlamp systems could efficiently host lidars, especially corner lidars, behind their protective cover lens; windshields could then preferably host long-range lidars. The synergy between headlamps and any lidar front end, requires the design of specific materials which will be compatible with both systems in term of light transmission; internal reflectance, and thermal constraints.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Ouster Will Be Exclusive Long-Range Lidar Supplier for Motional AVs

Ouster has been selected as the exclusive provider of long-range lidar sensors for Motional's Hyundai Ioniq 5-based electric robotaxis. The serial production agreement will see Ouster supply Motional with Alpha Prime™ VLS-128 sensors through 2026.

The Alpha Prime delivers the long-range, high-performance capabilities we need for our autonomous vehicle," said Laura Major, Chief Technology Officer at Motional. "Long-range lidar is an important part of Motional's multi-modal sensor strategy, which includes over 30 sensors carefully integrated into the Ioniq 5 robotaxi design. This sensor suite provides 360-degree vision and enables safe, fully-driverless operation across diverse driving environments and conditions".

Founded in 2020 as a joint venture between Hyundai Motor Group and Aptiv, Motional deploys their L^4 AVs for ride-hail and on-demand delivery applications. Motional has operated a public robotaxi service in Las Vegas for over five years now. They've already begun implementing Ouster Alpha Prime sensors on their robotaxis in commercial operation in Las Vegas and Los Angeles, and they're testing operations in Boston; Pittsburgh, and Singapore.

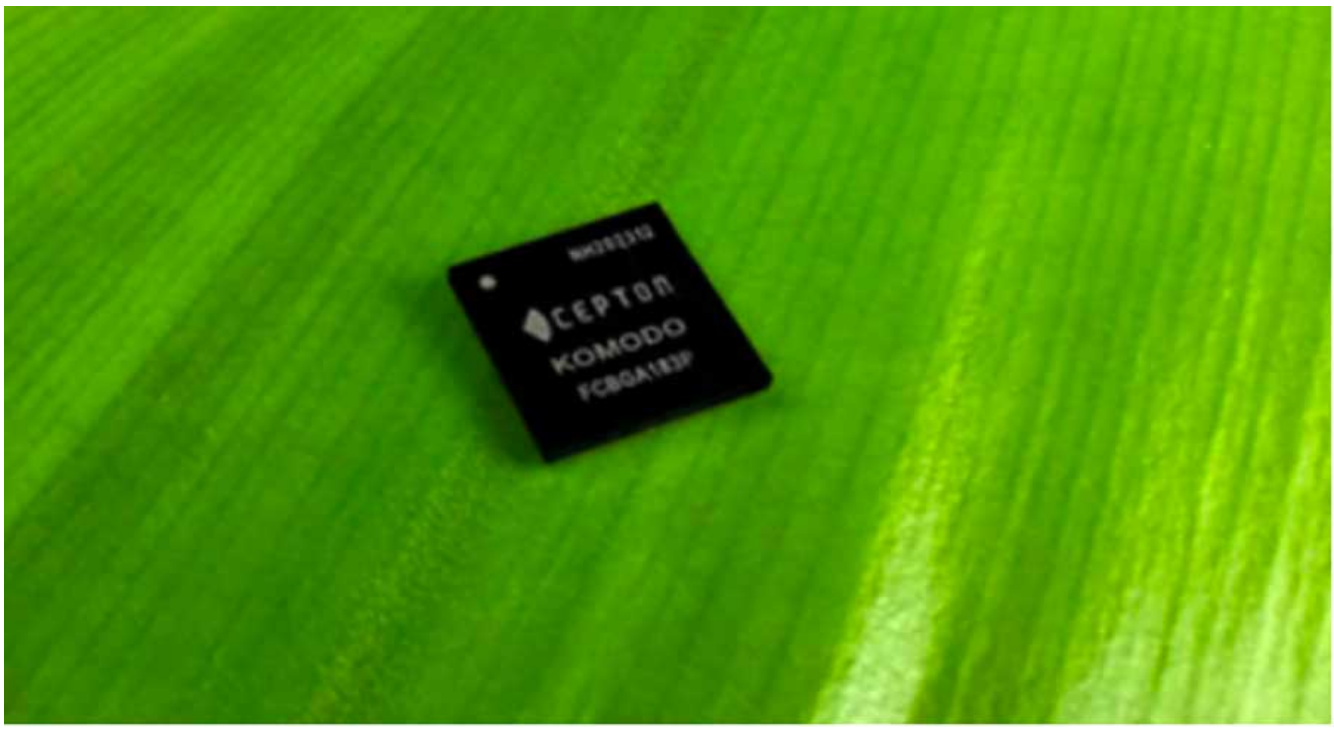
Ouster CEO and cofounder Angus Pacala says "Motional is a leading AV company with large-scale deployments and strong commercial partnerships. We're excited to be the exclusive long-range lidar on Motional's Ioniq 5 robotaxis being deployed globally. The Alpha Prime is a powerful addition to our product portfolio, and one that we expect will continue to drive meaningful new business, particularly for autonomous vehicles".

DVN comment

Good news for Ouster, who are known to equip robotaxis from the early stage, but are now facing growing competition from Chinese companies like Hesai.

LIDAR AND IMAGING RADAR TECHNOLOGY NEWS

Cepton's New Advanced Point Cloud Processor for Automotive Lidar



Cepton's new Komodo lidar point cloud processor ASIC chip has successfully achieved production-ready status, and is expected to begin shipping this quarter.

Developed in-house at Cepton's headquarters in Silicon Valley, the Komodo is a highly integrated custom SoC (System on Chip) designed to maximize the technical advantages of Cepton's patented lidar architecture to significantly improve point cloud quality, while replacing several merchant silicon devices to dramatically reduce cost. Advantages include:

- Superior performance: the Komodo is multiple times faster than the FPGA and merchant silicon chips it replaces. It features sophisticated digital signal processing, such as filtering and noise reduction, resulting in more accurate range and reflectivity measurements. With a peak throughput of up to 12 million points per second, it significantly enhances point cloud quality for higher resolution, which enables more accurate object detection and tracking at longer distances;
- Minimal power consumption: consuming under one watt, the Komodo is much more efficient than the FPGA and merchant silicon chips. The low power consumption of the Komodo and Iguana ASICs is a key enabler of Cepton lidars' versatility in vehicle integration for everyday passenger cars;
- 90-per-cent cost reduction compared to the FPGA and merchant silicon chips;
- Small packaging facilitates streamlined electrical and optical design to achieve top-quality 3D images in an ultra-compact package;
- A built-in functional safety monitor that is ISO26262 ASIL-B certified, enhancing the sensors' automotive-grade reliability for use in passenger cars, and

- Sensor fusion readiness: with multiple camera interfaces and high-speed data channels, the Komodo facilitates lidar/camera data fusion and communication with control units.

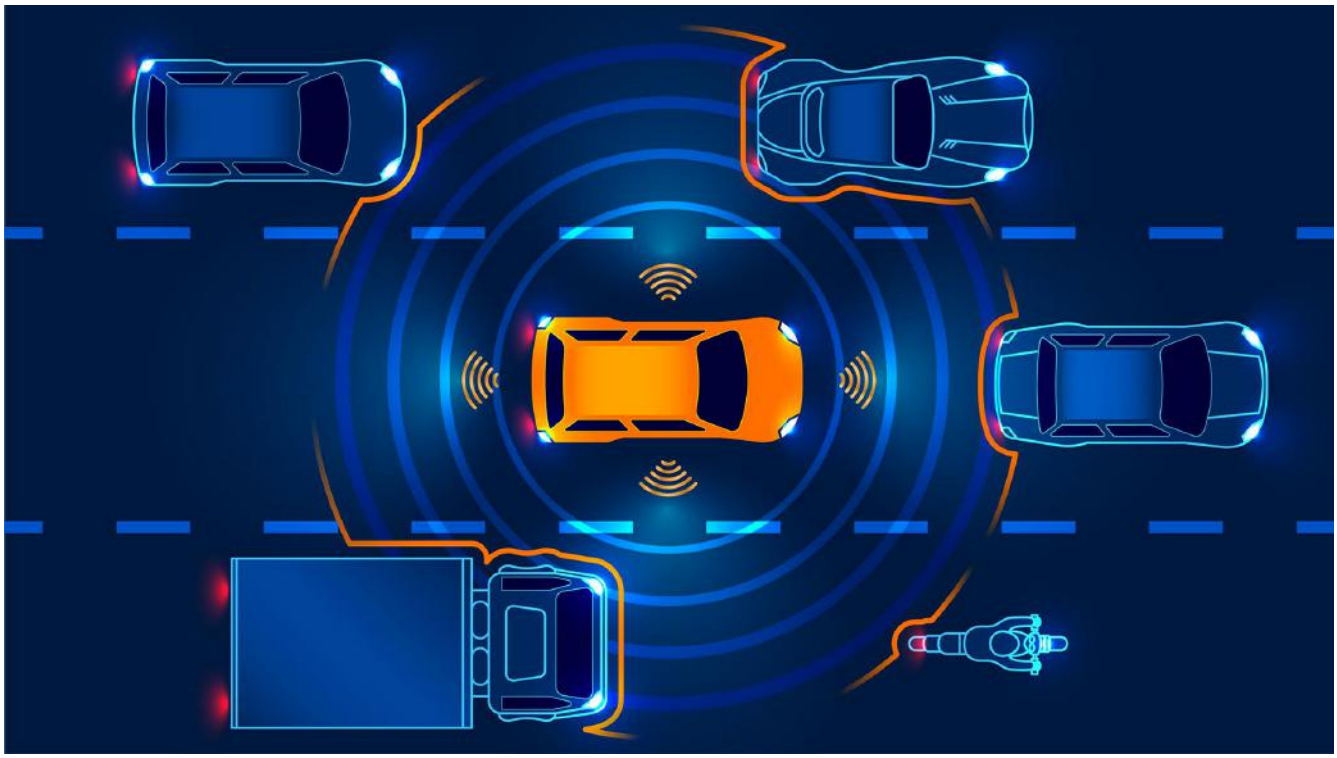
The Komodo bolsters Cepton’s strong position in proprietary lidar ASIC chipset development. Their Iguana ASIC, a high-performance single-chip lidar engine for advanced illumination control and detection, has been shipping in Cepton lidar sensors for years now.

DVN comment

The fact that Cepton has decided to produce this ASIC shows their confidenve in the maturity of their point cloud processing. Even if scanning systems remain highly application-specific and therefore expensive, the integration of this chipset will allow a significant cost reduction of Cepton's lidar family.

AUTOMATED DRIVING

AD Newsbites



Baidu predicts that by 2026 the market uptake of models equipped with their *L*$^{2+}$ advanced intelligent driving solution, including valet parking; highway navigation, and city navigation pilots, **will exceed 15 per cent**, marking a transition period for the intelligent vehicle sector. Baidu VP and GM of Apollo Self Driving says “Whoever can take the lead in providing consumers with a safe and secure intelligent driving experience will likely have a head start in the second half of the intelligent car competition”.

XPeng has been granted a license for intelligent connected vehicle road testing in Guangzhou for their G9 model. The license allows the testing to take place on all general testing roads in the city. **The G9 is the first mass-produced AV in China to obtain road-testing certification without hardware modifications, using only upgraded autonomous driving software**. The company also plans to launch a Robotaxi ride-hailing service in Guangzhou's Huangpu District this year, which will allow users to call a vehicle through a WeChat App.

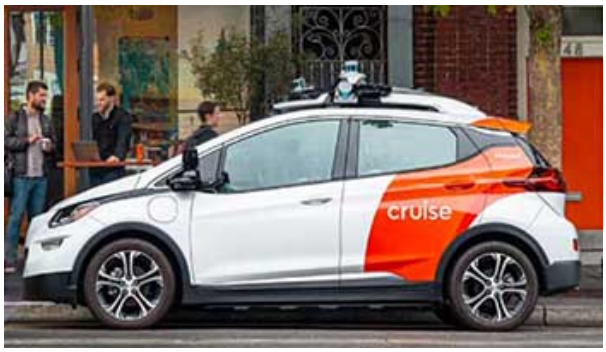
Xpeng has formed a strategic partnerships with Chinese insurance companies to accelerate AV insurance. they've unveiled a sophisticated intelligent online insurance service system that supervises the entire thing from quote solicitation to claims processing. Included in the partnerships are PICC Property and Casualty; Ping An Property & Casualty Insurance, and China Pacific Property Insurance. These alliances are intended to pave the way for a smart insurance service program that deliver appropriate insurance coverage for EVs.

Phil Koopman of Carnegie Mellon University is pushing for a simple approach to legal cases involving automation. To determine liability, courts should apply the same legal rules applied to human drivers: what would a 'reasonable' driver do? This would eliminate source code analysis, which is not practical. After an AV crash, the automaker would bear the burden of proving that the driver unreasonably ignored warnings to take control.

Baidu's autonomous driving ride-hailing service (robotaxi) platform, Apollo Go, completed about 660,000 orders in Q1-2023. The cumulative order volume of Apollo Go has now surpassed two million. Apollo Go currently operates in major Chinese cities such as Beijing; Shanghai; Guangzhou; Shenzhen; Wuhan, and Chongqing. Baidu wants to expand the service scale, with a goal of deploying an additional 200 fully-unmanned robotaxis nationwide, in a bid to establish the world's largest autonomous driving operating service area.

Waymo is expanding their robotaxi service areas in Phoenix and San Francisco. In Phoenix, the company's Jaguar I-Pace vehicles will now cover a total of 180 square miles—twice as much as before. In San Francisco, the company is now covering the entire peninsula with a free, 24/7 robotaxi service. They say they're providing 10,000 fully autonomous trips to public riders every week. Nevertheless, Waymo is still in the learning phase; recently, the fog in San Francisco caused a pack of five Waymo AVs to stop and stay stopped, causing a minor traffic jam.

Waymo and Uber have announced a multi-year strategic collaboration. The goal of this alliance is to extend the reach of Waymo's self-driving technology to a broader audience through the Uber platform. The public launch of this integration is planned for later this year, involving a set number of Waymo vehicles operating in Phoenix, the company's newly expanded territory. The partnership will provide local deliveries and ride-hailing trips.



Cruise has announced **the launch of their robotaxi service, operating 24/7 across San Francisco**. This marks a major milestone for the company; they've been developing this technology for nearly a decade. The rollout of the robotaxi service will be conducted in stages, initially available to employees and soon to the general public.

Pony.ai has become the first firm to obtain a **permit for driverless passenger transport in Guangzhou**, in a 310 square mile area of the city's Nansha District. Pony started driverless testing in Guangzhou in June 2021. As of this past April, they have accumulated over about 21 million km of autonomous driving globally, and 994,000 km of driverless testing.

DiDi has inaugurated their autonomous cargo truck brand, **KargoBot**. KargoOne is composed of one autonomous driving-enabled pilot vehicle with a human driver onboard, with multiple L^4 autonomous trucks following behind. This system works with end-to-end cargo transport under various complex scenarios, including short- and long-distance trips. The KargoOne platooning model allows KargoBot to cut energy consumption by up to 10 per cent. As of March this year, KargoBot has transported more than 1.2 million tonnes of coal, with a logistics revenue exceeding C¥100m.