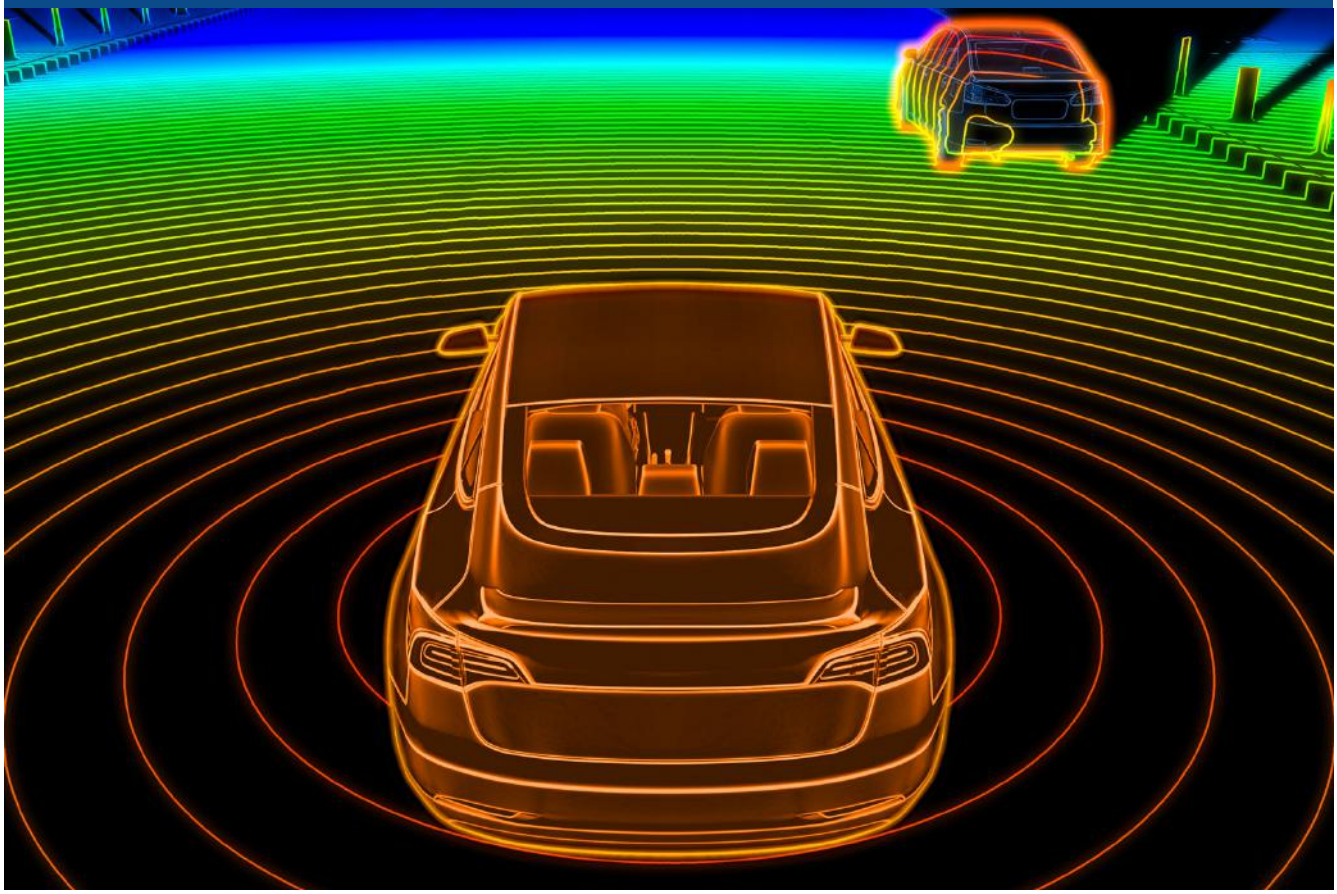
DVN
Lidar

# Monthly newsletter #11

FEBRUARY 6, 2023



EDITORIAL

# Take Me To Your Lidar: 2023 is the Year We Make Contact!


## *Editorial · February 2023*

It's only February, yet it's already clear that 2023 is the year when lidars and hands-off driving assistance systems move out from the lab and onto the roads...this is DVN's primary main takeaway from CES 2023!

In this edition of the DVN-Lidar Newsletter, you will find our custom-tailored coverage of this year's CES. Lidar, artificial intelligence, and automated driving were front and center this year. Many companies showcased their latest lidar innovations for driver assistance and autonomous vehicles, as well as other sectors like home automation, augmented reality, and urban infrastructure.

We see leading ADAS suppliers roaring to market with products like Mobileye's hands-off automated driving systems (both eyes-on-road like Tesla's 'Autopilot' and eyes-free like Mercedes' Drive Pilot), and Bosch's $L^4$ valet parking system. Naturally, lidar is a crucial, central component for $L^3$ and $L^4$ systems.

We bring you our interview with Manuel Ligges, in charge of optical systems at Fraunhofer IMS. Take a look and see his insights on developing Lidar components and applications. And of course, you will find our monthly lidar news, including a presentation of the lidar coalition in the US, and recent innovations regarding lidar products and components.

Be sure and **save the dates** for these don't-miss DVN events:

- DVN-L Deep Dive I (Europe): 27-28 February at Dorint Wiesbaden (docket in this Newsletter)
- DVN-L Deep Dive II (Europe or Asia): end of May
- DVN-L Deep Dive III (USA): end of August
- DVN-L Conference (Europe): 29-30 November at Dorint Pallas Wiesbaden

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

All best,

**Alain Servel**

*DVN LIDAR ADVISOR*

*NB: Our newsletter is published the first Wednesday of each month (apologies for this month's delay)*

CES 2023

# CES 2023 · DVN-L Special Report - Automated Driving Market Trends


## • Passenger Cars

We took great hope at seeing so many innovative hands-off systems under active development, slated to come on the market in 2025 and '26. Mobileye is getting orders in China and Europe for their hands-off/eyes-on SuperVision system, for example, which also means Tesla, in order to keep up with increasingly polyvalent and performant competition, will have to up their game (in real-world terms of hardware and software and capability, not just on Twitter).

Here is how these kinds of products will likely gain market traction:

**Priority 1:** Clear, honest communication on what the system can *really* do—bogus names like 'Full self-driving', already under severe legal and regulatory scrutiny, will increasingly not be tolerated. To avoid confusion, Mobileye prefers to explicitly categorize hands-off systems in terms of modes, for example by distinguishing eyes-**on** (the road) $L^{2+}$systems like 'Autopilot' versus eyes-**off** (the road) $L^{3}$ systems like Drive Pilot.

**Priority 2:** Convincing customer value by extending the ODD and number of countries where at least one of the hands-off modes is usable. The next generation of systems, starting from 2025, must have a large ODD. So how's that going? Well, in eyes-**on** systems, GM has doubled the ODD of their hands-free Super Cruise driving assistant, now available on over 644,000 km of highways in the US.


And Mobileye's eyes-on system has found favor with six automaker customers (and counting), and can support a full ODD including highway; inter-urban, and urban roads. The first customer is Geely for their Zeekr marque, which started production last year. Mobileye expects orders for their hands-off/eyes-off systems soon, too.

Meanwhile, eyes-**off** systems are already out there. Following its introduction in Germany in mid-2022, Mercedes announced the introduction of Drive Pilot (a traffic jam chauffeur for speeds of up to 60 km/h on highways) in Nevada and soon in California.

**Priority 3**: Validated, highly safe systems. This is a big challenge for eyes-off systems, which must be 10× times safer than a human: one accident every 16 million kilometres, a target becoming standard among automakers. Mobileye calls it "absolutely necessary to provide real data to the customers so they can trust the eyes-off systems", and presented a practical path to build a safe system: first launch the vehicle model with eyes-on functionality, with all the sensors required to get the eyes-off functionality eventually, when everything and everyone is ready. To reach that readiness, collect data-data-data over millions of kilometres to demonstrate safety. Accumulating 16 million miles means six months with 100,000 cars and four hands-off activations per month.

**Priority 4**: Scalability and optimized cost and price. The market is currently evolving for eyes-on systems—necessitating enormous investment to transition from what went before (much more basic driver assistants, like cruise control). The next transition, going from eyes-on to eyes-off, should be shaped and managed now, in advance, to avoid later reinvention of wheels and the attendant duplication of effort and expense. Mobileye's proposal is based on a scalable concept: a pure vision system of 11 cameras can support eyes-on functionality (like Tesla), then an additional lidar and radar are used to support the eyes-off option which needs redundancy.

For architectures with two independent systems—different technologies like this—validation of the radar and lidar system can be added to that of the camera-vision system to show the robustness of the composite supersystem. With 10,000 hours of tests of the vision system and 1,000 hours of tests of the radar and lidar systems, safety performance can be demonstrated: 10,000 ×1,000 = 10,000,000 hours without a mishap.

## • Automated Valet Parking

Imagine a world where you won’t need to waste your time looking for a parking space! It’s almost here in Stuttgart, Germany, since November 2022.


That's when Mercedes and Bosch announced the first approved automated valet parking, an L4 system, going on the market for the EQS and S-Class. Germany’s Federal Motor Transport Authority approved the system for use in the parkade at Stuttgart airport.

## • Robotaxis

2023 will see robotaxis introduced more widely in commercial applications around the world. The technology is ready to be tested with small fleet of 500 to 1,000 vehicles, to educate customers first and test the concept at affordable costs. Then Volume is expected to grow progressively in the 2025-'30 timeframe, up to 10,000 vehicles a year per operator.

**Mobility as a service (MaaS) projects in Munich; Darmstadt, Hamburg**


Mobileye has obtained a permit recommendation from TÜV SÜD in Germany, enabling Mobileye to operate their AV technology, embodied as Mobileye Drive™-equipped Nio ES8s on German roads with a human safety driver.


And the first Holon-Benteler pilot project will take place in Germany with Hamburg’s Hochbahn, the country’s second-largest mass-transit company. In the U.S., mobility provider Beep will implement the first vehicles, which are scheduled to enter production at the end of 2025.

## • Autonomous Delivery

The zero-occupants segment might see a much faster deployment than robotaxis, once it has been tested at a larger scale, since the business model is very promising. Like Robotaxis, the first commercial deployments are starting.

Nuro, for instance, is a California-based startup who say they're the first to receive approval for a self-driving vehicle exemption from the U.S. Department of Transportation, and a deployment permit from the California Department of Motor Vehicles, enabling them to launch the first commercial autonomous vehicle service in the state.

Nuro's electric vehicles are designed for a full day of operation from a single charge, and the company has piloted delivery vehicles with FedEx; 7-Eleven, and others.

## • Autonomous Trucks

In an October 2022 report on the prospects for autonomous trucks, Boston Consulting Group said autonomous driving technologies could reduce the cost of long-haul trucking by more than 30 per cent through labor savings and driving efficiency gains. Because trucks would no longer have to sit idle while their drivers rest due to shift limits, vehicle time-in-use could more than double.

Autonomous-drive companies including Aurora; Einride; Embark; Kodiak; Plus; Torc; TuSimple, and Waymo have been building the technology to bring solutions to market while forging partnerships with truckmakers, freight companies, and fleet operators. Here are some examples:


Paccar has been showing off their Peterbilt 579 equipped with lidar and cameras. The vehicle is L4-capable and is currently running pilots with Aurora in West Texas.

Two years ago, Waymo Via partnered with Freightliner's parent company Daimler Truck North America to develop a redundant L4 autonomous truck platform for the Waymo-driven Freightliner Cascadia. Through this partnership, DTNA has built an L4-ready system meeting Waymo technical requirements.


The special Cascadia is equipped with a fifth-generation Waymo Driver. About 50 of these early-build pilot trucks are operating in Texas and Arizona with Uber Freight; J.B. Hunt, and others. And a revised 'beta' build of this model is said to be coming soon.


Aeva and Plus have demonstrated a next-generation design for the PlusDrive highly automated trucking solution. The two companies have been collaborating since 2019 to equip and validate Plus' autonomous trucking solutions with Aeva's FMCW 4D lidar.

INTERVIEW

# Interview: Fraunhofer IMS Optics Boss Manuel Ligges Fraunhofer IMS

Manuel Ligges earned his diploma and physics Ph.D. in 2009 from the University of Duisburg-Essen, where he continued to work as a senior researcher in light-matter interaction. In 2019, he joined the Fraunhofer Institute for Microelectronic circuits and Systems (IMS) in Duisburg as the Head of Optical Systems.

## DVN:  Manuel, thank you for talking with us. Fraunhofer is a well-known applied-research organization with 77 institutes worldwide, each covering specific technology areas. Can you tell us about the focus of Fraunhofer IMS?

**Manuel Ligges**: The Fraunhofer Institute for Microelectronic Circuits and Systems—IMS—is traditionally a 'silicon institute' with a strong background in CMOS technology, and also part of the Forschungsfabrik Mikroelektronik Deutschland (FMD), which is Europe's largest R&D coöperative for nano- and microelectronics.

We operate in-house cleanroom facilities for CMOS and MEMS fabrication. A main focus of our research goes towards smart and embedded sensor systems, which includes the design and fabrication of Si-based sensor core technologies; their refinement by means of microsystems technology, but also smart sensor control and data processing (classical and embedded-AI based) and system level integration.

Exemplary developments include uncooled IR sensors, wireless transponder technologies; in-house RISC-V implementation AIRISC, and our platform-independent embedded AI-suit AIfES. The optical lidar sensors based on our in-house SPAD technology are part of this research and development focus. We are mainly but not exclusively targeting four business branches: health; industry; mobility, and space & security.

## DVN: During your presentation at our last conference, you mentioned the NeurOSmart 'lighthouse' project, looking at data reduction methods important for future lidar systems. Tell us more, will you?

**ML**: In general, Fraunhofer Lighthouse projects aim at exploiting the synergies of different Fraunhofer Institutes to provide solutions for current challenges of the German Industry. In this particular Lighthouse Project with the Fraunhofer ISIT, IPMS, IWU and IAIS, we aim at the development of hybrid computing architectures for autonomous machines and transportation systems. The higher-order problem here is that advanced levels of autonomy will require more sensors, higher degrees of complexity in data fusion, corresponding computing power and energy consumption.

We are working on both, dedicated hardware and software solutions to address these issues. The data reduction method I presented is part of a lidar use case scenario where we aim at the implementation of an intelligent feedback loop based on a latency-reduced AI-based data analysis and a controllable sensor architecture, which will allow us to reduce the overall data stream and the power consumption of the total system.

We want to demonstrate this architecture in a human-robot interaction scenario, where violations of spatial 'safety zones' by humans are supposed to be detected with very low latency and high accuracy. For this purpose, we are in constant exchange with each other, harmonizing specifications and requirements as well as the current state of each actor’s core technology development and the overall project progress. The project funding is granted for a period of three years, in which we defined several milestones. Beside apparent frequent technical and organizational project meetings, there are also several higher-level status review meetings to track the overall progress of the project.

## DVN: What specific research areas does IMS focus on in this collaboration?

**ML**: The Fraunhofer IMS has two major tasks within this project. At first, we are developing the overall optical lidar concept and system in close collaboration with the other Fraunhofer institutes. In this course we are also responsible for setting up the complete system. We will use a hybrid flash/scanning approach to first roughly capture the whole target scene. Subsequently we identify regions of interest (ROI), reconfigure the sensor and laser scanner, and then finally map the ROI with high precision.

Besides the development of the concept itself, the whole sensor architecture as well as the laser scanners have to be developed, adapted and precisely synchronized. As a second task, we are using our hardware/software co-development to quickly reduce the overall amount of data, as presented in my talk, and prepare the compressed data for subsequent object identification, which is required for the feedback loop mentioned above.

These processes are performed on an in-house developed RISC-V based multicore system, which will provide the infrastructure to operate digital neuromorphic AI accelerators. On the lidar side, we will profit from the novel flash/scanning hybrid approach, which can be used in a variety of different application scenarios. On the hardware/software side our developments are not tied to lidar applications, but adoptable to different use cases that involve other sensor concepts or architectures as well.

## DVN: What are the main technology challenges you face?

**ML**: The optical concept for the NeurOSmart project use case is set, and we do not expect significant surprises. Challenges are mainly on the signal processing side, where we are aiming at a low latency AI-based data processing. For this purpose, we need to optimize the network structure and signal chains in great detail, while tailoring the underlying hardware platform towards the specific task. This hard-/software co-design is challenging, but greatly profits from the fact that we have competences on both fields in our institute and are embedded into an excellent consortium.

## DVN:  Fraunhofer uses the ATLAS emulator to accelerate the development of ADAS, avoiding numerous real-track tests. Can you take into account the effects of bad weather and the different types of lidar waveforms?

**ML**: First, we are working at solutions that mostly match our own core technology and system development which is mostly 905-nm laser based direct time-of-flight (dTOF). In this approach, it does not matter whether you use scanning or flash methods, as the emitted spatio-temporal structure of the lidar laser will be recognized by the system. For dTOF methods operating at other wavelengths, the concept can easily be adopted by using different laser and optical trigger technologies. The same concept also holds for indirect TOF methods which, however, are less frequently used in the context of ADAS.

The system is capable of simulating sunlight radiation as a 'bad weather' situation and we are also working on detailed concepts for the simulation of rain and fog. Effectively these perturbations act the same as sunlight as they generate temporally uncorrelated background photons that to not contribute to the (partially suppressed) real TOF signal. In terms of AMCW or FMCW lidar methods, the situation becomes immediately more complex as the phase, chirp and/or detailed temporal AM needs to be tracked and remodelled by the system. While we have general concepts for such solutions on the table, we are afraid that they need to be way more system-specific and such, are currently of less interest as a Fraunhofer core technology development.

## DVN:  Can the measurement screen emulate a point cloud?

**ML**: Yes, overall the concept starts with a first, single pixel screen that is capable of simulating almost arbitrary distances at one point in space. The main idea is to subsequently reduce the complexity of this single pixel approach in a way that the concept becomes scalable at reasonable costs and effort. We have to determine the total size and number of pixels of such a screen depending on the needs of potential partners, customers and the industry.

## DVN: Can your technology help reduce lidar power draw?

**ML**:  Our total system is aiming at the generation of the point cloud as well as an object and human identification scheme without further needs of data processing. These are tasks which are often handled separately. The main driver of power consumption is the latter part which requires a lot of computational power but is absolutely necessary for the evaluation of the point cloud in ADAS. For the overall system, we estimated a reduction in power consumption of roughly 50 per cent.

## DVN: Will the advanced technology you are developing be equally applicable and needed for short-, mid- and long-range lidar sensors?

**ML**: SPAD-based sensors are in particular outstanding in terms of their scalability which makes them the ideal candidate to realize sensor arrays. In this sense, our main research focus is based on flash systems, which are nowadays most suitable for short- to mid-range applications as the total power of currently available low-cost laser sources is limited and not yet constrained by eye-safety regulations. As mentioned above, we are also currently exploiting hybrid methods, where we try to combine the best of both worlds and aim at higher ranges.

## DVN: When do you expect first road tests with your technology? What will be the further schedule?

ML: Our main focus is the core technology development rather than the design of full product-like lidar systems. In this regard we are currently mainly focused on foresighted topics like sensor fusion, edge computing, but also novel concepts for system integration.

One example is the development of a 'smart headlight' within a Fraunhofer consortium. Here, we combine lidar; radar, and conventional lightning in a co-axial geometry using special combiner optics which will allow for easy system integration while maintaining automaker form factor restrictions. Off course we are also working on further improvements of our SPAD sensor technology in terms of sensitivity, timing behavior and advanced read-out circuitry.

---

## DVN: Manuel, we thank you for your time and your thoughts! We wish you and the Fraunhofer team great success, and we hope to see you and colleagues from Fraunhofer at our upcoming DVN lidar events.

LIDAR NEWS

# Lidar Coalition at CES


The Lidar Coalition focuses on promoting the deployment of lidar-based 'intelligent' infrastructure and automotive safety technology. They engage in public policy advocacy; educational efforts, and thought leadership to maximize the public benefit of lidar deployment.

Ariel Wolf, Chair of the Autonomous and Connected Mobility Practice Group at Venable LLP—who serve as legal counsel to the coalition, said he was "excited" to see the innovative lidar tech at CES, *to* "demonstrate lidar's unique potential to enhance safety for roadway users and pedestrians through immersive experiences and simulations and through panels and joint initiatives with business partners".

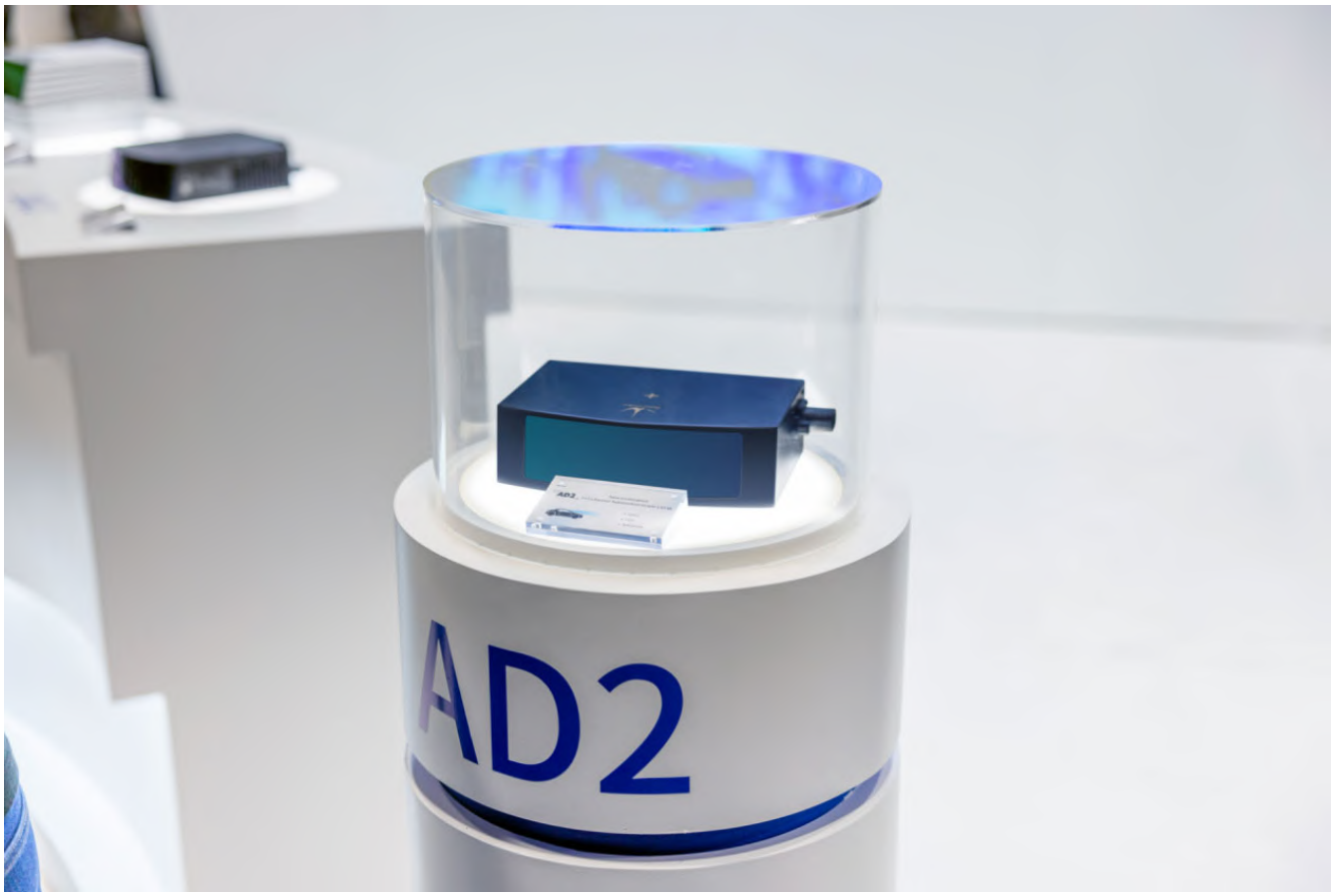
Members of Lidar Coalition: Aeluma; Aeva; AEye; Baraja; Cepton; Continental; Ibeo; Innoviz; Outsight; Ouster; Quanergy; Valeo, and Velodyne.

DVN comment

The Lidar Coalition is a new lobbying entity which started in the middle of last year to promote the benefits of lidar to public bodies like NHTSA. We can expect them to find critical use cases where lidar can increase significantly the safety level, like collision avoidance scenarios with pedestrians at night—a difficult case for a pure vision system—or with objects suddenly falling from a truck—a tough case for a hands-off system wherein the driver cannot be expected to take over instantly.

LIDAR NEWS

# Benewake's 512-Line Lidar




At CES, Benewake unveiled their new 512-line, automotive-grade AD2 lidar. They demonstrated their technology in a high-definition vehicle road test, enabling participants to experience the real-time perception function.

Safety is the most important thing for intelligent driving, and how to allow sufficient observation and response time for intelligent driving users is a critical factor which is considered by most lidar companies. Benewake developed the AD2 to give high-performance detection capability to provide a safer driving experience.

CEO Dr. Yuan Li gave an example: at 100 km/h, the AD2 will identify small targets like a like 22-cm flat tire much earlier than a previous-generation 128-line lidar, giving an additional 2.1 seconds for the intelligent driving system to perceive and control. This means human- or self-driven cars can slow down sooner, without emergency braking, or switch to another lane to bypass the obstacle, thusly avoiding accidents.

As the primary lidar product from Benewake, the AD2 has a 120° × 25.6° field of view, 10-Hz frame rate, and 200-metre detection range. The AD2 targets high-resolution detection in regions of interest, so it can detect and identify multiple targets over its large view field. 0.05° × 0.05° angular resolution enables it to detect obstacles with 10-per-cent reflectivity at 200 metres, and to clearly identify the outline and shape of small targets from up to that same distance away. This significantly improves the recognition rate at the software level, and reduces the risk of system misclassifications and errors.

Benewake has innovated the scanning and optical transceiver with laser and detector array technology of the Horn platform. Through 2D high-precision scanning technology, 512-line high performance can be achieved without large-scale arrayed light sources and receivers. And the AD2 has digital motor technology from Benewake's in-house research, to accurately control the speed and moving position of the prism and galvanometer for accurate perception of space. Optimization of the architecture means the unit is small and easy to embed in the car body.

Through an agreement with manufacturing outfit Jabil, Benewake will achieve mass production delivery of 180,000 automotive lidar by the end of 2023. CEO Dr. Yuan Li has said mass production is the threshold that must be crossed for lidar commercialisation.

DVN comment

Benewake was founded in Beijing in 2015. They are a technology company focusing on autonomous driving, CV2X, rail transit, civil aviation, shipping, and industrial applications. Benewake’s business covers 60 countries and regions around the world, and the products are exported all over the world. Their new AD2 lidar will be mass-produced by Jabil in the USA this year, but so far no news about which automakers are looking at buying them.

LIDAR NEWS

# Innovusion's Live Lidar Demo at CES


Innovusion, experts in design and development of image-grade lidar technology, showed off their products for autonomous driving at CES this year. Their long-range Falcon lidar was honored with a CES Innovation Award.

At CES, Innovusion exhibited a bird’s eye live view of intersections of booth walkways. Visitors could also experience an immersive and interactive VR journey of Las Vegas landmarks on the Strip. Innovusion’s long-range Falcon lidar and short-to-midrange Robin lidar covered the surrounding view of a vehicle to support safety, comfort, and efficiency in many autonomous driving scenarios—highway; city, and automated parking.

The Falcon lidar's novel architecture with integrated optics and scanning elements provides a 3D real-time point cloud image with simultaneous long-range and high-resolution picture. It can detect objects at up to 500 metres away, and even dark objects with just 10-per-cent reflectivity at up to 250 metres with 90-per-cent POD (probability of detection).

It is the first product of its kind being mass-produced for consumer vehicles, and has been integrated as part of the standard sensor system in the Nio ET5; ET7, and ES7/EL7) in 2022, lowering barriers to entry to high-performance autonomous driving for the broad consumer base.

The Robin, on the other hand, is a short-to-midrange lidar built on the latest electronic and photonic technologies. It produces a 3D point cloud image of its surroundings with a 905-nanometre laser. It is modular, and can be highly customized to meet the varying requirements of different customers. Its optical window and body frame can fit a variety of vehicle exterior designs. Its ultra-compact size allows Robin to be integrated onto side fenders, headlamps; rear lights, and bumpers. The Robin can detect a 10-per-cent reflective object up to 180 metres away, with 90% POD under 100k Lx illumination. It has a field of view of up to 140°H and 90°V, with resolution of 0.2° × 0.2°. It caters for highway lane changing; traffic merging; unprotected intersection turning; roundabout driving, and urban cruising.

By the end of 2022, Innovusion had delivered more than 50,000 Falcon lidar units for production vehicles—the highest delivery volume of any lidar manufacturer in the world. This year, the company will achieve a production capacity over 300,000 per year and can easily be expanded within months to support future demands from global automakers.

DVN comment

Innovusion has partnered with Nio for Falcon lidars integrated in Nio’s ET7 electric sedan. Nio has built up a full-stack autonomous driving system including perception algorithm, localization, control strategy and platform software. It features 33 high-performance sensing units, including 11 8-megapixel high-resolution cameras, 1 Falcon lidar, 5 millimetre-wave radars, 12 ultrasonic sensors, and two high-precision positioning units.

LIDAR NEWS

# Opsys Tops Up Venture Effort With Additional $36.5m

VCSEL array lidar

Opsys Tech, one of several startups developing automotive lidar technology in Israel, says they have raised an additional USD $36.5m in their latest venture funding round. The additional cash, which brought total series C funding to $51.5m, will be used to ramp up production of commercial devices built around their solid-state platform.

Eitan Gertel, the former CEO of major VCSEL manufacturer Finisar, cofounded the startup and now is their executive chairman. He says, "With the closing of this financing round, we can complete the full production ramp of our True Solid-State Scanning lidar product line, and we are looking forward to supplying our customers with production quantities of our lidar sensors".

Opsys says theirs is a lidar sensor uniquely capable of high performance and reliability at low cost, which can meet all user requirements, and has no moving parts. Opsys also claims a detection range of 300 metres at 10-per-cent object reflectivity, which are based around an array of vertical-cavity surface-emitting lasers (VCSELs) operating at 850-980 nm and single-photon avalanche diode (SPAD) detectors.

During CES, Hasco—a major Chinese tier-1 supplier—announced that they've chosen Opsys Tech as their lidar sensor supplier for their automotive ADAS. The two companies will be deepening their collaboration in the design; development, and manufacturing of pure solid-state lidar-enabled automotive ADAS; mass production of lidars could start in 2024.

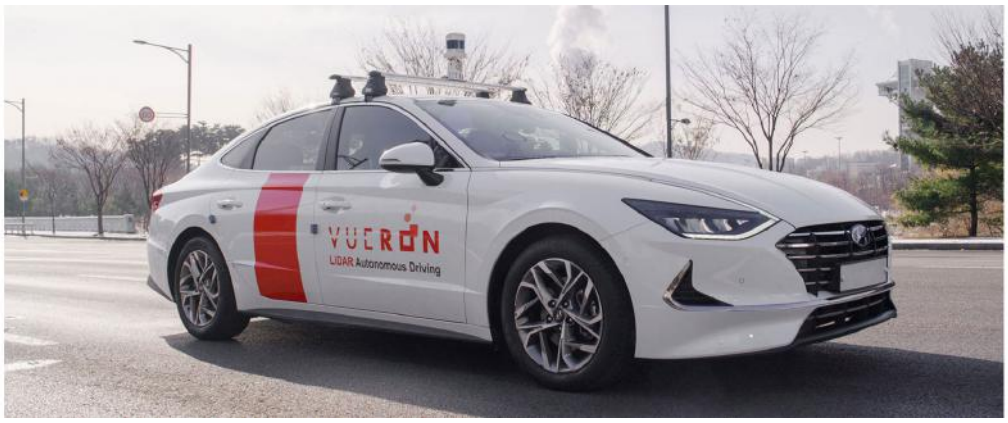
Opsys CEO Rafi Harel, who was the general manager of Finisar Israel for several years, says the Hasco tie-in "marks our entrance into the market for mass production quantities of automotive lidar systems in Asia. The use of Opsys lidar technology will increase the safety of vehicles on the road while enabling the evolution of autonomous functionality at all levels, including $L^5$ ".

DVN comment

Opsys was founded in 2016 by an integrated team with proven track record in electric optical systems. Their experience in scalable production and automation manufacturing helped them design their first sensors so as to preserve at any step of design, a real adaption to volume production.

LIDAR NEWS

# Vueron's VueOne Lidar-Based ADAS




Vueron Technology, established in 2019, is a tech startup specializing in lidar. They have developed innovative lidar-based ADAS for $L^{2+}$ and above, to deliver a higher level of safety.

Vueron's flagship product, their VueOne, is powerful enough to perform autonomous driving on a real road using only one lidar with no other sensors. It can be run on automotive processors already used for camera-based ADAS. The CEO and CTO have many years of experience and expertise working for an automaker, and Vueron has been working with global automotive automakers and tier-1s for ADAS and autonomous driving.

In January 2021, Vueron became the world's first company to be granted an autonomous driving license using only one lidar sensor in South Korea. Expanding in the US, Vueron obtained a self-driving permit in California and Nevada, using only one lidar. Vueron's autonomous driving fleet now covers multiple continents, allowing for continuous performance improvement.

At CES this year, the company revealed their new, innovative lidar-based ADAS for $L^{2+}$ or above, available immediately for practical production. Additionally, Vueron's self-driving car with the lidar-only autonomous driving system was available to visitors who wanted to try out the experience.

DVN comment

By principle, due to their fine resolutions, a majority of lidars can ensure lane detection in addition to their objects ranging capabilities, so they could replace efficiently the classical radar/camera couple. But in term of safety, especially when we consider L3-4 AD (eyes-off), it is agreed by virtually all automakers (except one) and all relevant experts that redundant sensor technologies are necessary for system safety adequate to meet standards like ISO 26262.

LIDAR NEWS

# Zvision's Short-Range Lidar at CES


Zvision, a Chinese supplier of automotive-grade MEMS lidar equipment, formally launched their new short-range ML-30s+ lidar ML-30s+ at CES—with an ultra-large FOV; enhanced imaging effects; new automotive-grade hardware and software architecture, and customized engineering

The ML-30s+ lidar has an ultra-large FOV of 140° × 70°, so it can detect a vehicle advancing from behind 1.4m earlier than a 120° system, which gives the vehicle's systems (or the human driver) an extra 300-700 ms to respond. And in context of 360° blind spot coverage, the blind spot splicing of 140° is half the size of that for 120°.

As to vertical FOV, the ML-30s+ has an asymmetric design that directs the limited FOV to the closest blind area. The -50° (placed horizontally) of the ML-30s+ is the largest design in the industry, which can effectively detect objects at ground level: low safety guardrails, bricks, boulders, stone abutments, safety cones and other road obstacles, as well as accurately identifying lane and parking markings.

The angular resolution of 0.44° × 0.44° and the frequency of 512,000 points per second (in single echo mode) mean the ML-30s+ meets the requirements for constructing a detailed map of the object. This allows to obtain 20-point clouds from the black-clad pedestrian at a distance of 22 m, and 6 point clouds from the triangular cone barrel at a distance of 25 m. The new lidar also has good ranging capabilities under severe weather conditions. Through unique algorithm and sensor technologies, the ML-30s+ can achieving stable and clear detection in the dark, and also does well in direct sunlight, providing reliable 3D sensing capability for autonomous driving under all kinds of working conditions.

The ML-30s+ has an unusual non-coaxial architecture. The MEMS mirror module is responsible for the two-dimensional scanning of the transmitting module, while the pure solid-state receiving module is responsible for the gaze reception of large FOV. The two do not interfere with each other. As for device reliability, the MEMS mirror module comes with new proprietary packaging, as well as temperature and humidity resistance and vibration shock resistance at the highest level in the industry. The design life tops 50,000 hours, fully meeting the requirements of passenger vehicles.

A short-range lidar like this closely monitors the area immediately adjacent to the vehicle body, which will inevitably interfere with the surroundings of the vehicles, resulting in abnormal point clouds such as body noise and point cloud adhesion. This affects the correct judgment of the ADS and may result in emergency braking or slower forward progression. Zvision has accumulated years of practice in short-range products; through specific point removal models and algorithms, the special software in the ML-30s+ functions to resolve point clouds in proximity to the body, and can adapt to different body shapes to meet the requirements of efficient mass integration.

Zvision offers an end-to-end integration solution including multiple radar installation error prevention, off-line calibration, dirt detection and cleaning, hibernation wake-up, and window heating. It effectively reduces the difficulty of various engineering development aspects before and after lidar onboarding, and improves overall vehicle integration efficiency, thus lowering apposite costs.

Zvision says they are the first producer in China to complete the whole process of R&D and mass production of short-range lidar. In the past three years, the company's first-generation short-range lidar has been widely used by JDL, Inceptio Technology, Mobileye and Deeproute.

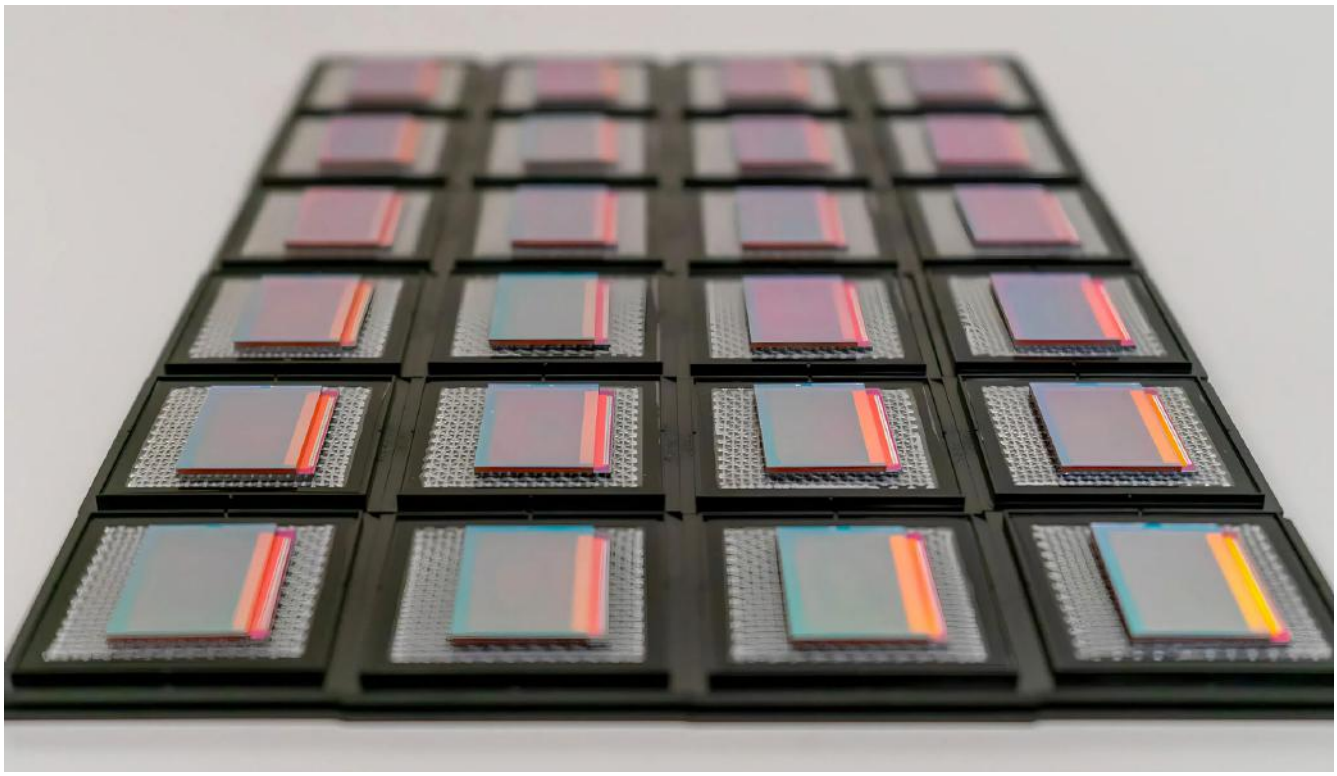
---

DVN comment

**Founded in 2017, Zvision has developed a full suite of MEMS lidar solutions covering long-range, short- and medium-range applications. In June last year, Zvision announced the completion of hundreds of millions of C¥ worth of series-B financing, led by Intel Capital and Chinese investment institution and startup platform Sinovation Ventures in Series B1 and Series B2, respectively.**

LIDAR COMPONENTS

# Lumotive's Metamaterial Beam-Steering Chips



Lumotive, a startup based in Seattle, Washington, is developing beam-steering semiconductor chips based around optical metasurfaces. At CES, they announced they have raised USD $13m in a new round of venture finance.

The support, provided by Samsung Ventures plus new investors USAA (United Services Automobile Association) and Korea-based electronics distributor Uniquest, brings total investment in the firm to $56m, and is intended to accelerate the development and customer delivery of its devices for advanced lidar sensing.

Lumotive—Bill Gates was an early investor—won a Prism Award in 2022, and can says they are engaged with “more than two dozen world-class companies” looking to use the supplier's patented light-control metasurface (LCM) chips.

The devices are being aimed at next-generation lidar systems for autonomy, automation, and augmented reality markets. Suitable for software-defined lidar with no mechanical parts required to steer the beam—and therefore zero mechanical inertia—Lumotive says their LCMs can steer light in any pattern across the entire field of view, within microseconds.

Manufactured in a major chip foundry using a silicon CMOS process and compatible with vertical-cavity surface-emitting lasers (VCSELs), the approach aims to take advantage of mass-produced photonic and electronic devices to reduce the cost and size of lidar sensors.

Lumotive says the design and assembly process closely resemble smartphone production, with an architecture that can be scaled from tiny close-range sensing to the kind of high-performance, extended-range operation required by AVs. At last year's Vision trade show in Stuttgart, Germany, the company demonstrated a reference design platform combining its LCMs with time-of-flight CMOS image sensors from development partner Gpixel, adding that an updated version suitable for volume production should become available by mid-2023.

Lumotive CEO Sam Heidari said the latest funding will "accelerate the deployment of the current generation of LCM chips and the development of the next generation of our product".

DVN comment

Zero-inertia beam steering, capable of arbitrary scan patterns, allows a sensor to adapt to any situation. It reduces overall system cost by supporting unlimited virtual sensors in a single device. It enables scan modes that instantly react to the scene, such as HDR illumination. This is an evident advantage in comparison with classical MEMs or macro mechanical mirrors which have always the same scanning pattern even if some parts of the FOV have no interest.

# DVN-Lidar Deep Dive 1: 27-28 February


The first DVN-Lidar Workshop of 2023 will take place this coming 27 and 28 February at the hotel Dorint Pallas in Wiesbaden. Here's the docket in its current form:

## 27 February

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

## 28 February

8:30 Opening and introduction of participants
9:00 Automaker presentation including key questions for break-up groups
9:30 Supplier presentation including key questions for break-up groups
(The theme for both presentations is **contamination and cleaning**)

10:00 Coffee break

10:30 Four breakout groups, each discussing two questions
11.30 Breakout group reporting and discussion

12:15 Lunch break

13:30 Tier-2 presentation including key questions for break-up groups
14:00 Research outfit presentation including key questions for break-up groups
(The theme for both presentation is **lidar performance in bad weather conditions**)
14:30 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