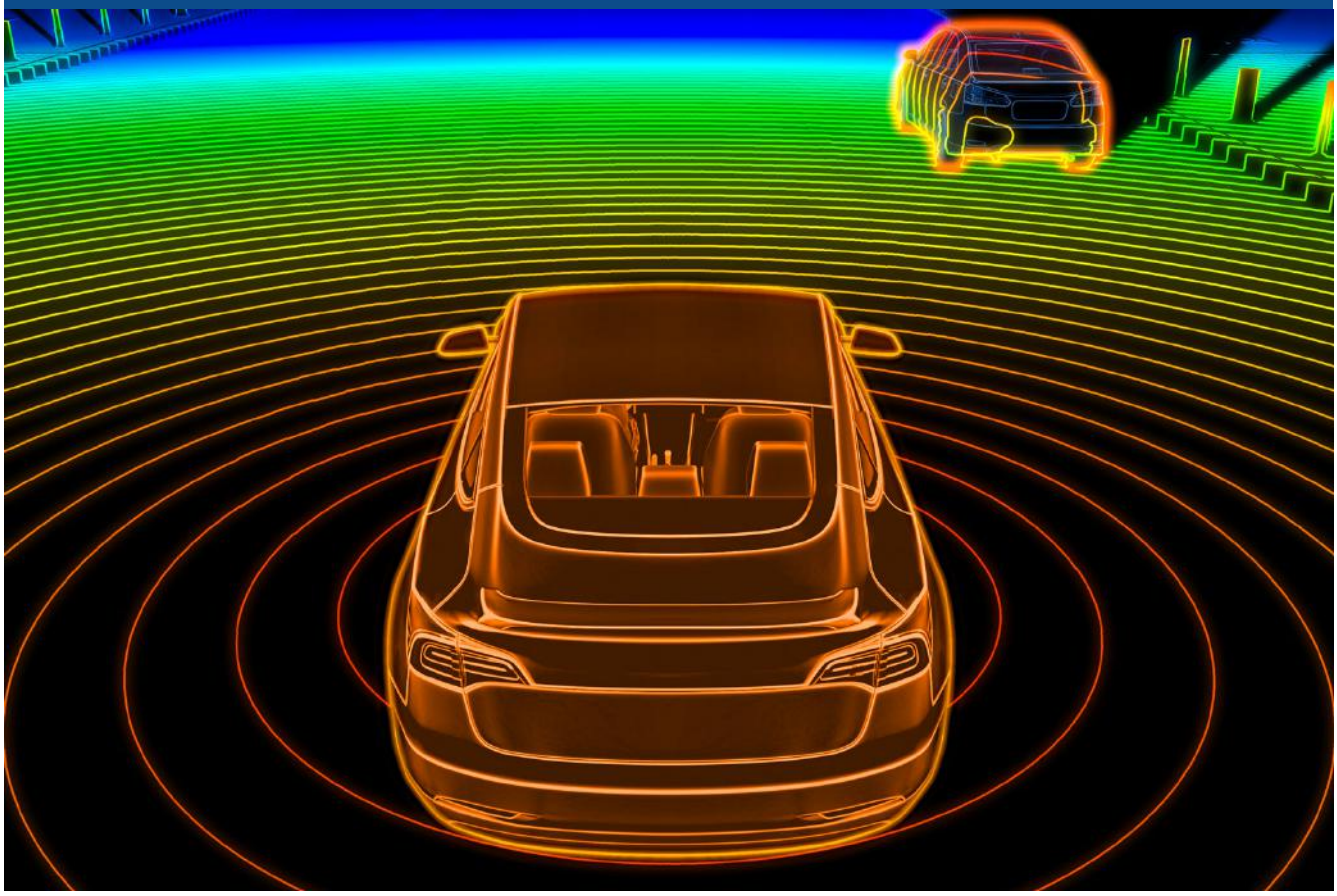
DVN
Lidar

Monthly newsletter #9

DECEMBER 7, 2022



DVN Lidar Conference: A Grand Success!

December· 2022

Once again, the DVN Lidar conference was a smashing success. About 150 people involved in the realization and implementation of lidar sensors gathered on the 30th of November and 1st of December at the Wiesbaden Dorint Hotel. About 75 companies shared their developments and expertise on lidar products and related services. Lidar sensors require sophisticated components across fields including optronics; optics; laser sources; detector arrays; calibration tools; signal processing; protection and cleaning; integrational solutions, and test equipment and protocols.

Even as the organizers, we were impressed by the quality of the 30 lectures and the showcasing at 18 expo booths and in three demo vehicles. Automakers including Mercedes; BMW; Ford; Honda; Hyundai; Nissan; Stellantis, and Volvo were on hand, with tier 1 represented by the likes of Continental; Koito; Marelli; Valeo; ZKW, and many more.

We got a great deal of positive feedback in the conference room, from the stands and during the meals. This shows an increasingly interest in lidar technology—even though hurdles remain, particularly in terms of costs and volumes. The presentations will be available in a week or two, pending review by the speakers.

One of many interesting innovations was from Baraja, who presented a complete solid-state sensor using 1D spectrum scanning as well as an FMCW-type waveform to offer high spatial and doppler resolution. A most impressive demonstrator vehicle was presented outdoors. Another innovative principle was presented by the Red Creamery company, and in this newsletter we present our interview with Red Creamery CTO Dmitriy Yavid.

And breaking news announced during the conference was the acquisition of Ibeo by Microvision; you will find more information about that in this newsletter. You'll also find coverage of Scantinel's photonic chip—also exhibited during the conference—and other new products and happenings in the vehicle lidar industry.

Be sure to subscribe and join in at our DVN Lidar events in 2023:

- February: Lidar Deep Dive 1 - in Europe
- May: Lidar Deep Dive 2 - in Europe or Asia
- August: USA West Coast Lidar Deep Dive 3
- November: Lidar Conference in Europe

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

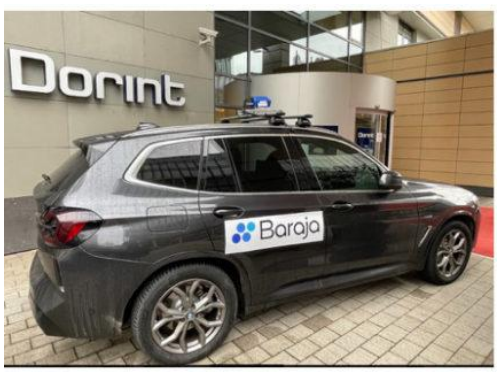
All best,

Alain Servel

DVN LIDAR ADVISOR

Wiesbaden DVN Lidar Conference

With around 150 participants; 18 exhibitors; 30 speakers, and three demo-cars, the latest DVN Lidar Conference was a grand success.



Last things first; let's start off with a sample of the feedback we've had from attendees:

"This event is unique, we can meet here all the key players working on lidar, which is not the case for other events such as the Autosens conference".

"A complementary event for component suppliers compared to other events such as Photonics".

"A live conference (no online participation) is the right format to get attendees coming and generate multiple contacts within two days".

"We can get a broad view of the applications, regulations, technologies and components".

"We get a good picture of the market dynamic".

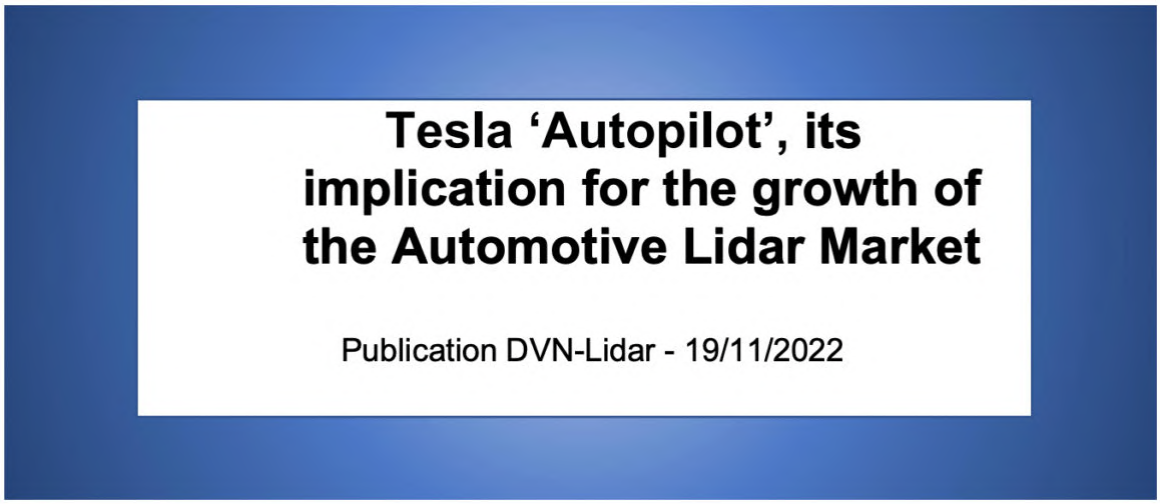
"This new location is better than last year, with the meeting room and booths on the same floor, and a right sizing".

Executive Summary of the Conference

- Markets: lidar is still in the emerging phase in Europe; Japan, and Korea with a focus on L^{3+} AV applications. Regulations are getting ready, step by step. Lidar might see standard applications sooner in China, which is more based on L^{2} applications for premium EVs; China already represents 50 per cent of the lidar wins in 2022, as reported by Yole.
- Added value: the new generation of lidars can now solve one of the critical use cases for AD, by detecting small objects on the road at distances beyond 200 meters. We also see high resolution and doppler lidars contributing more efficiently to pedestrian detection, with recognition of legs and arms. This is very good news in terms of the potential safety benefits of lidar.

- Technology: lidar technology is still in a creative phase, with a wide range of alternatives proposed. Standardization is not yet approaching, and we're still watching restructuring events. The good news is we can see small packaging coming—5 × 5 cm aperture—and affordable solutions are possible with a compromise on performance; it won't be the perfect long-range lidar.
- How to achieve volumes? We might learn from the history of automotive radar. It started with long-range radars for ACC, quite expensive with limited volumes. There were multiple suppliers, and a poor business case. Then the blind spot detection rear radar was launched: cheaper and with a safety benefit readily visible to the end user—the icon in the rear-view mirror—and with a clear customer demand. This was the starting point of radar market growth.

Also see our DVN White Paper: ***Tesla 'Autopilot' and its Implication for the Growth of the Automotive Lidar Market***. It provides analysis to help everyone understand the customer demand and expectations regarding safety performance for ADAS/AD, and it's accessible to all DVN members.



First keynote

Valeo's Marc Vrecko (photo), Valeo's ADAS VP, described how his company see 'platformization' as the main driver to reduce costs—of which software development and product validation are a major chunk—with solid manufacturing expertise necessary to secure the SOP with a sophisticated product.

Lidar and Applications: Speakers and Quotes

On lidar deployment:

Mercedes-Benz's Christian Kobetz: "we need to increase the availability of Drive Pilot—countries and speed range—to bring more value to the customer and to increase demand and volumes."Cristina Galassi from The European Commission: "The regulation for $L^{3\text{-}5}$ AVs published in August 2022 is a major step forward to facilitate a quick deployment in all EU countries."

On lidar benefits:

Stellantis' Vincent Abadie: "Lidar is the best 3D free-space sensor ever," key for safety applications.

Ford's Patrick Piastowski: "Small-object detection is one of the key benefits of the Lidar technology, but it has to become affordable for family cars."

On integration of Lidar

Achim Freiding from HKM: "5 × 5cm is a good target for lidar integration in lamps."Henri Haefner from Cepton: "it is possible to integrate Lidar behind the windshield."

On markets and standards:

Valeo's Clement Nouvel and Mind's Zu Ping Zhu: "The EU is focused on L^{3} and China is focused on L^{2+}. Local brands, competing with Tesla, sell lidar as a differentiator for safety." Pierrick Boulay from Yole: "The Chinese market is speeding up, with a lot of brands applying lidar on EVs; this represents 50 per cent of the wins in 2022."Adrian Zlocki from FKA: "First DIN-SAE spec early in 2023, then an ISO standard at the end of 2023."

On lidar performance:

Wolfgang Schulz from Continental using the Aeye 1,550-nm lidar technology and MEMS: "Performance results for small object detection such as bricks, tires, palette show a detection range above 200m."Thomas Luce from Microvision: "We need to be prepared to avoid lidar interference risks and mitigation." ZKW's Thomas Reiter: "We can detect motorcycle and pedestrians with a lidar fused with a camera."

On lidar technology:

Baraja's Joseph Notaro: "Our spectrum-scanning design is an alternative to MEMS, very robust and potentially affordable."

Red Creamery's Dmitriy Yavid: "We have an ultra-high-resolution lidar."

Andy Zott from Scantinel: "The photonic integration solid state FMCW lidar sensor is on the way."

Opsys' Alex Leuta: "Our micro-flash scanning lidar has a small packaging and very low cost."

Second keynote

Bircan Taslica, TÜV Rheinland's head of V2X, ADAS-AD, and 5G, shared insights about V2X and ADAS regulations and testing: "TÜV have all facilities to support all testing requirements".

Components and Ecosystem: Speakers and Quotes

Clemens Hoffmann from AMS Osram, about lidar emitters; market trends, and design challenges: "FMCW will come slowly."

Manuel Ligges from Fraunhofer: "We can achieve a 90-per-cent reduction of data rate for the SPAD technology, which is one roadblock for future applications."

KSLD's John Peeks: "Our multifunction laser (white light + IR) can support V2X with LiFi communication capabilities."

Jens Fischer from Doctor Optics: "we are introducing new high precision lens for Lidar applications"

Canatu's Toro Tolonen: "We have a new nanotube solution for transparent heating features."

Niklas Anderrmahr from Dioptic: "We are providing robust solutions for optical design and optical testing for lidar sensors, in lab and on [the] process line."

Ansys' Fabien Bastide: "We have many customers for our lidar simulation toolchain."

Exhibitors

The list of expert companies showcasing their innovations, products, services, and expertise included SOS Lab • Kyocera Soraa Laser Devices • Valeo • Microvision • Red Creamery • Baraja • Scantinel • Opsys • Canatu • Dioptic • Schott AG • LiangDao • ZKW • IMS • TÜV Rheinland • Marelli • Fraunhofer • Mobias

DVN-L Startup Interview: Dmitriy Yavid, Red Creamery CTO

Dmitriy Yavid is chief technical officer and cofounder of lidar specialist supplier **Red Creamery**. His career spans over 30 years of developing opto-electromechanical products, with emphasis on laser sources; laser scanners, and their applications. He has worked in corporate and consulting roles, including at Motorola's Applied Research Center, where his services were recognized by a Master Innovator Award. He holds over 70 patents covering a wide variety of engineering subjects, and is a member of ASME; IEEE, and Optica.

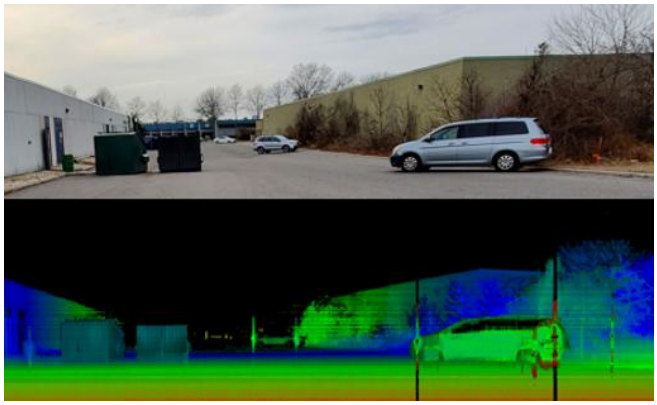
DVN: Dmitriy, thank you for talking with us. Will you tell us a little more about your company?

DY: I would begin by saying that all key people of Red Creamery, including myself, have been fortunate to work in the past for Symbol Technologies—a very innovative company which brought bar code scanning technology into wide commercial use. Many of us later worked on other laser scanning applications in various fields, so, naturally, thinking about lidar, we were thinking about scanning.

The idea of mechanical modulation, which forms the basis of Red Creamery's lidar technology, was born around 2015; by 2018, we'd got serious about pursuing this idea: Red Creamery was established and funded in a friends-and-family capital raise to the tune of $8M, the engineering team formed, key vendors contacted, and key patent applications filed. The next four years were spent putting engineering flesh on a scientific skeleton: we wanted to make sure the technology works as expected, and the only way to be sure was to put everything together and see it actually working. Now we're there.

We've developed our own MEMS mirror, which is, to our knowledge, the highest optical resolution scanner in the world, and secured custom sensors and lasers from reputable manufacturers. The collection optics, as well as some important aspects of signal-processing electronics, are of our design as well. We've put everything together and were pleasantly surprised with system performance. At the same time, we've received extremely broad patent protection.

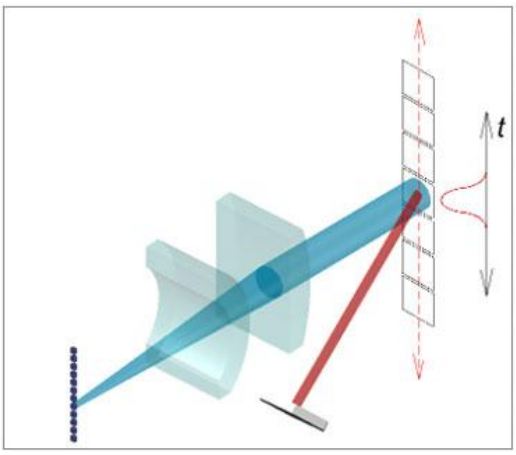
So, our next goal is to find investors and industry partners to bring this exciting technology into production.

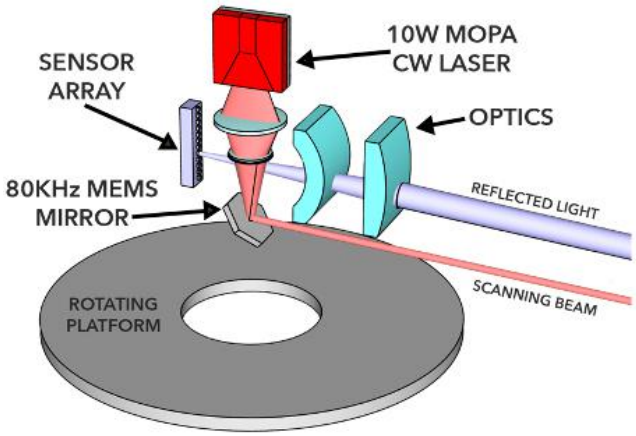


DVN: What are the benefits of your technology?

DY : Since we've got an excellent patent protection, we've decided not to be cagey, and speak openly about our technology and our specs. Our lidar provides a uniformly-spaced point cloud of 82 million samples per second within the 360 × 30-degree view field, at 20 frames per second, with the range of 200 m. This corresponds to 8000 × 512 pixels per frame, or an angular resolution of 0.045° horizontal and 0.06° vertical. This is continuous, uniform resolution across the entire FoV and with full range.

It is possible to configure our lidar for front-facing operation only, within, say, 120° horizontal, but that would not affect the point cloud density.





How do we achieve this? We use an unmodulated CW (constant- or continuous-wave) laser, but our MEMS mirror scans it so fast that each pixel of the sensor is illuminated for only a few nanoseconds. The sensor is a 1D array of 512 pixels, arranged vertically, and the scan is also vertical, so each scan line traverses all 512 pixels, giving us 512 data points. The mirror oscillates at ~80 kHz, and each mirror cycle consists of two lines: upward and downward. So, 80 kHz × 2 lines/cycle × 512 samples/line = 82 MSPS.

Fundamentally, this is a classic ToF lidar, with the sensor time-stamping the arrival of the reflected pulse, except that the pulse in our case is *not* a short burst of radiation emitted from the laser, but rather a short moment when the scanned CW laser beam is pointed in the direction of a given pixel—that's what we call mechanical modulation. The mirror oscillations are very tightly controlled, so that time of departure is known for every sensor pixel with sub-nanosecond accuracy.

The scanner and the sensor with collection optics are placed on a rotating platform, given us a 360° horizontal FoV, or may be together bounced off another slow scan mirror, for a front-facing system. It is also conceivable to have a 2D scanner, raster-scanning a CW beam across the FoV of a 2D sensor array—our mechanical modulation would still work, but we don't believe this would be an advantageous approach for a variety of technical reasons.

The very possibility of using a CW laser instead of a pulsed one is the main advantage of the mechanical modulation: generally, CW lasers are considerably less expensive and more efficient than their pulsed counterparts, and this is applicable to all classes of lasers: semiconductor, solid-state, fiber, VCSEL arrays, etc. A pulsed laser is a device which is idle 99 per cent of the time. On the other hand, when it is not idle, it works extremely hard, at very high-power density levels, leading to various losses, as well as design complications.

We opted to use a semiconductor MOPA (Master Oscillator-Power Amplifier) laser, which is fundamentally a large-area edge emitter, comparable in cost and efficiency to large multi-mode laser diodes but producing a single-mode beam which is needed for scanning. However, to match the average output of a CW laser diode, perhaps dozens of pulsed ones would be needed, each costing roughly the same as our single one. Speaking of efficiency: the main source of losses in a semiconductor laser is ohmic resistance, and the power dissipation in a resistor grows as a square of the current, and therefore, is inversely proportional to the duty cycle of a pulsed laser.

Our scanned CW laser very considerably lowers the cost of each collected data point, in terms of both dollars and joules of energy, thus uniquely enabling ultra-high resolution at low cost. Another cost advantage is in the sensor: since we only need a 1D array, it is only a narrow sliver of the wafer—a fraction of a millimeter in width, occupying only a few square millimeters of the wafer area, and sensors are typically priced per wafer area.

Additionally, it turns out 1D scanners with 1D sensors convey some unique optical advantages, which allow us to simultaneously see targets very far away and very close-by.

DVN: What made your company decide to go for automotive lidar applications?

	Projected Cost Range @ Quantity 1m Units	
Component	Low Range	High Range
Laser	$ 25	$ 25
Mirror	20	30
Molded Optics	40	50
Sensor	30	70
Electronics/Mechanics	125	150
Total Estimate BoM	**$ 240**	**$ 325**

DY : As businesspeople, we surely couldn't miss the enormous size of automotive market. On the other hand, as engineers, we see that our solution fits the automotive requirements very well: high resolution, long range and low cost. So, going after the automotive applications was a no-brainer. Having said that, we believe other applications might benefit from our lidar technology too, and we're looking at those, but still automotive remains our focus.

As I said, the key components—MEMS mirror, MOPA laser, and 1D sensor array—have been designed, fabricated, and tested, we've completed system testing, and have confirmed the expected performance.

DVN: Which wavelength have you chosen, and why?

DY: We presently work with 1,550-nm lasers and linear-mode InGaAs APD sensors. However, fundamentally we're sensor-agnostic and our system can work with any type of ToF-capable sensors at any wavelength. Our initial choice of 1,550-nm was mostly dictated by two considerations: first, we didn't have to worry about eye safety, and second, we could easily afford the relatively high cost of InGaAs, because of our small wafer area.

However, we believe that even at 905 nm we can stay within Class 1 while emitting several watts of laser power, and that should be sufficient to reach 200 m range with advanced silicon sensors. We're presently working in this direction. Another potentially interesting area, where our mechanical modulation may turn out advantageous, is time-domain coherent detection. By virtue of being continuously on, a CW laser of sufficiently narrow optical bandwidth becomes an ideal local oscillator for various time-domain coherent detection schemes. If successful, it might lead to considerable improvements in sensitivity, solar immunity, and interference robustness of future lidars. We've filed IP on this approach.

DVN : What about power consumption?

DY : Lots of data points means lots of laser power, and then lots of electric power, too. In our system, the laser dominates the power consumption, and for 1,550-nm system with a 10-watt CW laser and required cooling, the total can reach ~90W. A 905-nm system with 3W of laser power would be at ~25W.

DVN: How does your technology do in bad weather?

DY : Fundamentally our technology is subject to the same limitations in bad weather as other ToF lidars. However, in some situations we may be able to substitute quantity for quality: due to the sheer density of our point cloud, we might be able to present some meaningful information, even if, say, 90 per cent of the data points are lost. Still, there is no chance we'll see anything 200 m away in heavy rain or fog.

DVN: When do you expect to launch your first projects on production vehicles for use on public roads?

DY : This is not up to us. At this point, we have just lidar hardware, while a lot more is needed for any public-road project. We hope our road-grade hardware can be ready within two years if everything goes well, but the decisions about any public road projects will be in the hands of our industry partners.

DVN: How do you see the automotive lidar market evolving over the next five years?

DY : I won't speak of regional markets as I don't know enough about their specifics, but I believe L^3 vehicles will be the biggest market for lidars in the next five years. My gut feeling is that L^4 might become a 'lost generation', as L^5 robotaxis and trucks and delivery robots overtake the lidar market from high-end L^4 cars in private ownership, but this will probably happen more than five years from now.

MicroVision to Buy Ibeo Automotive

During the DVN Automotive Lidar Conference and Exhibition, there was a great deal of buzz about a potential acquisition of Ibeo. After ZF pulled out a significant part of their loans and investments some months ago, Ibeo filed for bankruptcy in the court of Hamburg, Germany.

Nevertheless, DVN welcomed Ibeo to participate actively in the conference as a presenter and chairman, in recognition of the company's pivotal role and pioneering engagement in automotive lidar applications.

In the afternoon on 1st December, MicroVision announced their partial acquisition of Ibeo: "MicroVision [has signed] an agreement to acquire certain assets from Ibeo Automotive Systems for up to €15m. The acquisition combines Mavin Lidar with Ibeo perception software features into the MicroVision ASIC for [automakers]. In addition, this acquisition expands MicroVision's multi-market strategy focusing on industrial, smart infrastructure, robotics, and commercial vehicle segments with Ibeo's flash-based sensor".

Under the terms of the asset purchase agreement, MicroVision will acquire Ibeo assets, IP, and teams to operate within the MicroVision organization. The closing of the acquisition is expected to occur during the first half of 2023, after regulatory clearance by German authorities

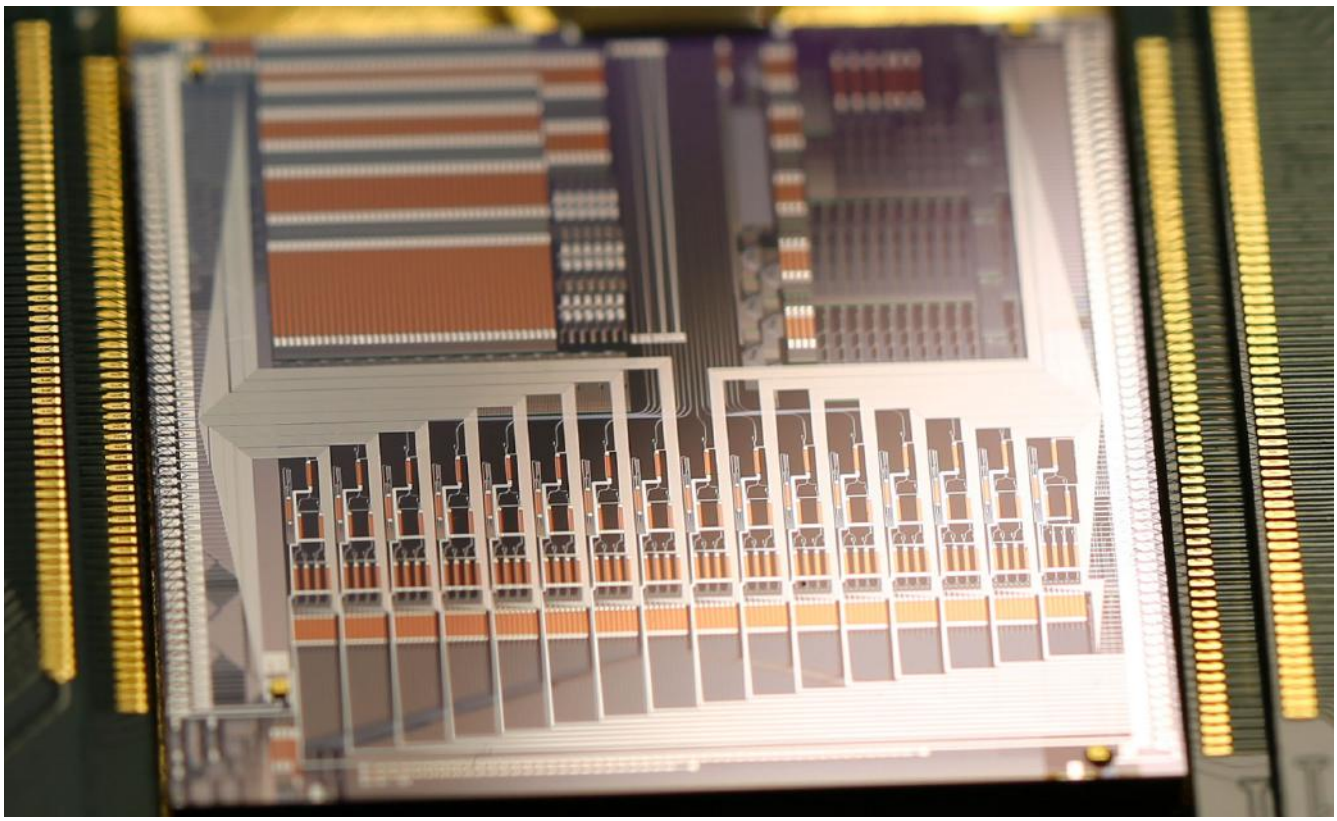
MicroVision CEO Sumit Sharma says "This is an exciting time as we welcome the Ibeo team to the MicroVision family. We believe this is the winning combination to accelerate our strategic plan at the exact right time. Our best-in-class hardware solution paired with existing perception features added to our ASIC, accelerated by the Ibeo software and automotive qualification experience, presents a significantly advanced solution. I'm also very excited about the immediate expansion of our multi-market strategy with Ibeo's sensor and hardware.This allows us to expand our total addressable market beyond automotive and diversify our revenue profile".

Revenue from a wider range of product lines could make MicroVision less sensitive to market changes. The range will comprise hardware sales from the Mavin sensor; Ibeo's existing legacy Lux sensor and their first-generation Ibeo Next flash lidar. Other revenue streams can come from royalties from Valeo's widely-commercialized Scala sensor, along with Ibeo's auto-annotation; validation; perception software and AD software used by automakers and others.

The forecasted revenue of $8m to $15m is expected from new and existing customers, including top-tier German and American automakers as well as non-automotive customers. MicroVision expects to use Ibeo's relationship with ZF to manufacture the Mavin lidar sensor. ZF has been producing lidar systems on behalf of Ibeo since 2020 for delivery to Great Wall Motor.

Ibeo's engineering, sales, and marketing capabilities in Germany and the United States will strengthen MicroVision's position in lidar hardware and software. The combined engineering teams in Hamburg and Redmond can create synergies in developing lidar hardware, perception software, ASIC,auto-annotation software, and other innovative ADAS and autonomous driving products.

Money Rains Down on Scantinel for AV Developments



Scantinel Photonics, a startup developing lidar solutions for mobility and industrial applications, has secured a €10m extended Series A funding round. The round was backed by PhotonDelta and current investors Scania Growth Capital and Zeiss Ventures. Scantinel will use the funding to roll out their FMCW lidar devices to market.Lidar is less interference-prone and more accurate and precise at detecting objects and mapping than radar or visible-light cameras.

That's why virtually the entire mobility world considers lidar imperative for effective, safe autonomous driving (the exception is Tesla, whose cocksure CEO Elon Musk thinks that lidar is dumb and that anyone who disagrees with him about this is wrong).

By using photonic chips, which use light instead of electrons to transfer information in microchips, Scantinel has developed their powerful, affordable, production-scalable FMCW lidar solution for broad application across industry and mobility. The solid-state technology delivers a detection range of more than 300 meters with superior resolution.. Scantinel has signed several partnerships with major global automotive, mobility and industrial companies.

The investment by PhotonDelta marks another step in their mission to build a European photonics ecosystem. In April, PhotonDelta secured €1.1bn in public and private investment to scale up production, build 200 startups, create new applications for photonic chips and develop infrastructure and talent. Scantinel cofounder and managing director Andy Zott says his company "see a great value having PhotonDelta as an additional investor and we are looking forward to maximizing the collaborations and benefits from PhotonDelta's leading integrated photonics ecosystem".

EX90 EV is "Safest Ever": Volvo

Volvo says their new EX90 electric SUV is the safest car they've ever built, thanks in part to the Safety Shield. Lidar; optical; ultrasonic, and radar sensors provide a 360-degree view around the vehicle to proactively cope with other vehicles and pedestrians, even if the driver doesn't immediately notice them. The EX90's lidar sensors can reportedly spot pedestrians up to 250 meters away. Volvo says the system could reduce the rate of all accidents by 9 per cent, and cut accidents resulting in serious injury or death by as much as 20 per cent.

Volvo president Jim Rowan says, "No matter how much experience you have or how much competence you have, at the end of the day, we are all still human. We want to help people become better drivers by being there when they're not at their very best".

For occupant protection and drivers monitoring, the EX90 has an in-cabin lidar—a world-first, designed to detect the presence of occupants and alert the driver if anyone is left behind in an effort to prevent hot-car deaths; Volvo notes that more than 900 kids have died in these circumstances in the US since 1998. Where allowed by regulation, the system will prevent the keyfob from locking the doors should a child or pet be detected inside.

The system also keeps an eye on occupants while the vehicle is in motion. The interior system can determine a driver's attentiveness based on their gaze. Volvo says this allows the car to detect when a driver is distracted, drowsy or otherwise inattentive, "beyond what has been possible in a Volvo car to date". Should the system catch the driver lacking, it will issue increasingly urgent alerts until it becomes clear that they are incapacitated, then the EX90 will automatically pull itself over and call for help.

Ford, VW Seek Buyer for Argo AI Lidar Unit

Ford and Volkswagen are trying to squeeze any remaining value out of Argo AI, the autonomous vehicle startup the two automakers invested billions in before abruptly shutting it down last week. One of the primary items on the block: Argo Lidar, an 80-person team and the lidar tech they developed.

Argo AI was barely a year old when they acquired lidar startup Princeton Lightwave in October 2017. The acquisition, backed by Ford, was hailed years later as helping to provide a key piece of technology in Argo's full self-driving system. The team, based in Princeton, New Jersey, developed medium- and long-range lidar sensors.

Argo has said the long-range lidar could see 400 meters away with high-resolution photorealistic quality and the ability to detect dark and distant objects with low reflectivity. In May 2021, Argo CEO and cofounder Bryan Salesky told TechCrunch that the lidar sensor was developed to be affordable and manufactured at scale, two factors that matter for any company trying to commercialize autonomous vehicle technology.

LG Innotek, a South Korean electronics components manufacturer, began manufacturing the lidar units for Argo this year. Sources say there has been interest from companies outside of the AV world in buying Argo Lidar's sensors. Whether any of these interested parties will jump at buying the entire lidar team is unclear. Meanwhile, some of Argo's 2,000 global workers are getting offers from Ford and VW. Combined, the two automakers invested $3.6bn in Argo. VW plans to reabsorb the Munich-based operations of Argo AI—an office with more than 200 people, many of whom previously were part of AID. VW is also offering jobs to about 100 former Argo employees based in the USA, which suggests the automaker is keen to set up North American operations.

Hesai's Changan ADAS Design Win

Shanghai-based lidar supplier Hesai says they have agreed a deal to provide their AT128 automotive-grade high-performance lidar sensors for a new car being built by Changan Automobile. Based around VCSEL (vertical-cavity surface-emitting laser) arrays emitting at 905 nm, the AT128 units are claimed to have a range of 200 metres for 10-per-cent-reflective objects.

Changan is said to be transforming themselves into a leading provider of electric vehicles, and revealed details of their new SDA smart car design earlier this year. And Hesai says their new manufacturing centre for automotive production will start operations this year, with a planned capacity of more than 1 million units and volume shipments of the AT128 for existing design-wins slated to begin before the end of the year.

The AT128 is an automotive grade, long-range main lidar designed for ADAS in series production vehicles. In September, Hesai became the first lidar company to ever achieve a monthly delivery of over 10,000 units. It has 128 integrated laser channels, reaching a point frequency of over 1.53 million per second. Its ultra-high-resolution scanning provides vehicles with 3D perception capabilities in real time.

RoboSense's New E1 Lidar

robosense

Lidar supplier RoboSense has officially launched their RS-lidar-E1, a flash solid-state lidar that sees 360° based on its in-house, custom developed chips and flash technology platform. Also announced was the only lidar lab of the industry recognized so far by the China National Accreditation Service, and a smart manufacturing joint venture called Luxsense, jointly with Luxshare-ICT.

The RoboSense E1 serves as a new product platform featuring area array transceiver technology with application-specific developed chips as the core. It is designed for large-scale series production with a simple bill of materials including no moving parts, and excels in all the three aspects of detection performance, cost, and automotive-grade safety and reliability. The E1 will assist partners to further bridge the gap in smart driving perception and improve the all-scenario perception capability of automated and autonomous vehicles. Main characteristics include:

- Horizontal FOV of 120°, which ensures 360° coverage using minimum sensors
- Vertical FOV of 90°, to cover both blind zones on the ground and lateral vision

- Ultra-high frame rates of over 25Hz, capturing target objects' motion state
- Detection range of 30m @10 per cent reflectivity, which enables better perception planning control.

The E1 uses RoboSense's first in-house, custom chips for flash solid-state lidar platform, and their first 2D electronic scanning technology. With highly integrated chips that incorporate the three core components of transmission, reception, and processing, the E1 greatly streamlines the circuit design and production processes.

To ensure product performance and rapidly improve production capacity, RoboSense launched the first—and so far the only—CNAS-certified lidar lab to analyze lidar and their components and developed a complementary smart manufacturing system to produce this high-precision sensor.

During the event, leaders of RoboSense and Luxshare jointly held the unveiling ceremony of Luxsense. Investment in the first phase of RoboSense smart manufacturing system exceeded C¥1bn cumulatively; the plant area exceeds 55,000 $m^{2,}$ including just under 20 automated production lines to achieve a production of a lidar every 12 seconds.

DVN comment

We still need to see how a short range lidar with 30m range can contribute to vehicle features. The standard range for radars doing almost the same job for a much cheaper price is 40m today.

Luminar Chosen for Nvidia AV Reference Platform

Luminar Technologies' lidar solution has been selected to be part of the sensor suite in the Nvidia Drive Hyperion autonomous vehicle reference platform. This AI vehicle computing platform accelerates development of autonomous consumer vehicles with planned production starting in 2024. By offering automakers a qualified, complete sensor suite featuring Luminar's lidar solution on top of Nvidia's centralized high-performance compute and AI software, Drive Hyperion provides everything needed to develop production autonomous vehicles.

Drive Hyperion will use one forward-facing long-range Luminar Iris lidar in its L^3 highway driving configuration. The Iris' custom lidar architecture is designed to meet the most stringent performance, safety and automotive-grade requirements to provide excellent safety as well as assisted and autonomous driving on production vehicles.

Luminar founder and CEO Austin Russell says "Nvidia has led the modern compute revolution, and the industry sees them as doing the same with autonomous driving. The common thread between our two companies is that our technologies are becoming the de facto solution for major automakers to enable next-generation safety and autonomy. By taking advantage of our respective strengths, automakers have access to the most advanced autonomous vehicle development platform".

And Nvidia senior VP of engineering Gary Hicok says his company's collaboration with Luminar "bolsters the Drive ecosystem of companies that are focused on building best-in-class technologies for enabling autonomous driving functionalities; Luminar is pioneering a unique, scalable solution that complements the NVIDIA DRIVE Hyperion platform".